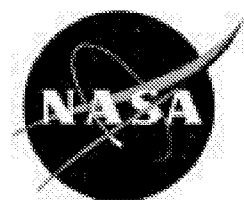


NASA/SP—2000—7037/SUPPL419
September 2000

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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Records are arranged in categories 1 through 19, the first nine coming from the Aeronautics division of *STAR*, followed by the remaining division titles. Selecting a category will link you to the collection of records cited in this issue pertaining to that category.

01	Aeronautics (General)	1
	Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft.	
02	Aerodynamics	1
	Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery.	
03	Air Transportation and Safety	8
	Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in <i>09 Research and Support Facilities (Air)</i> . Air traffic control is covered in <i>04 Aircraft Communications and Navigation</i> .	
04	Aircraft Communications and Navigation	17
	Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control.	
05	Aircraft Design, Testing and Performance	20
	Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.	
06	Avionics and Aircraft Instrumentation	29
	Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also <i>04 Aircraft Communications and Navigation</i> ; <i>08 Aircraft Stability and Control</i> .	
07	Aircraft Propulsion and Power	31
	Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.	
08	Aircraft Stability and Control	36
	Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also <i>05 Aircraft Design, Testing and Performance</i> and <i>06 Avionics and Aircraft Instrumentation</i> .	
09	Research and Support Facilities (Air)	41
	Includes airports, runways, hangars, and aircraft repair and overhaul facilities, wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also	

includes airport ground equipment and systems. For airport ground operation see *03 Air Transportation and Safety*.

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|-----------|---|-----------|
| 10 | Astronautics (General) | 45 |
| | Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. | |
| 11 | Chemistry and Materials (General) | 48 |
| | Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. | |
| 12 | Engineering (General) | 48 |
| | Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. | |
| 13 | Geosciences (General) | 54 |
| | Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. | |
| 14 | Life Sciences (General) | 56 |
| | Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. | |
| 15 | Mathematical and Computer Sciences (General) | 58 |
| | Includes general topics and overviews related to mathematics and computer science. | |
| 16 | Physics (General) | 59 |
| | Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. | |
| 17 | Social and Information Sciences (General) | 61 |
| | Includes general research topics related to sociology; educational programs and curricula. | |
| 18 | Space Sciences (General) | 61 |
| | Includes general research topics related to the natural space sciences. | |

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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 419)

SEPTEMBER 2000

01

AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft.

20000083074 National Aerospace Lab., Tokyo Japan

Aerodynamic Characteristics of a Three-Dimensional HLFC Wing in Transonic Flow

Ishida, Y.; Noguchi, M.; Suzuki, K.; May 1999; 30p; In English; Original contains color illustrations

Report No.(s): PB2000-106335; NAL/TR-1385T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We conducted a transonic wind tunnel test of an HLFC wing model with a new leading edge suction system incorporated with a natural laminar flow airfoil to check mainly the drag reducing effect of the suction system in the transonic Mach number range. The test confirmed that the system works well in both design and off-design conditions, resulting in significant drag reduction in a wake drag with even a small amount of suction. Besides the drag reducing effect, we found that the system produces considerable lift increase for some suction quantity ranges in a wide range of test Mach number. The lift increment generates a higher L/D value than that which may be expected from the drag reduction alone.

NTIS

Aerodynamic Characteristics; Transonic Flow; Wing Profiles; Laminar Boundary Layer; Boundary Layer Control; Three Dimensional Models; Wind Tunnel Tests; Laminar Flow Airfoils

20000083875 NASA Langley Research Center, Hampton, VA USA

Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 418

August 2000; 64p; In English

Report No.(s): NASA/SP-2000-7037/SUPPL418; NAS 1.21:7037/SUPPL418; No Copyright; Avail: CASI; A04, Hardcopy

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-2000-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.

CASI

Aeronautical Engineering; Bibliographies; Aerodynamics; Indexes (Documentation)

02

AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery.

20000080347 NASA Langley Research Center, Hampton, VA USA

Hypersonic Boundary-Layer Trip Development for Hyper-X

Berry, Scott A., NASA Langley Research Center, USA; Auslender, Aaron H., NASA Langley Research Center, USA; Dilley, Authur D., NASA Langley Research Center, USA; Calleja, John F., General Applied Science Labs., Inc., USA; [2000]; 30p; In

English; 18th; 18th Applied Aerodynamics Conference, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-4012; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Boundary layer trip devices for the Hyper-X forebody have been experimentally examined in several wind tunnels. Five different trip configurations were compared in three hypersonic facilities, the LaRC 20-Inch Mach 6 Air Tunnel, the LaRC 31-Inch Mach 10 Air Tunnel, and in the HYPULSE Reflected Shock Tunnel at GASL. Heat transfer distributions, utilizing the phosphor thermography and thin-film techniques, shock system details, and surface streamline patterns were measured on a 0.333-scale model of the Hyper-X forebody. Parametric variations include angles-of-attack of 0-deg, 2-deg, and 4-deg; Reynolds numbers based on model length of 1.2 to 15.4 million; and inlet cowl door simulated in both open and closed positions. Comparisons of transition due to discrete roughness elements have led to the selection of a trip configuration for the Hyper-X Mach 7 flight vehicle.

Author

Boundary Layers; X-43 Vehicle; Wind Tunnel Tests; Scale Models; Forebodies; Hypersonic Flight

20000080474 National Aerospace Lab., Amsterdam, Netherlands

Technical Report of National Aerospace Laboratory. Design and Development of an Oscillating System for 2-D Wing Models

Kikuchi, T.; Jan. 2000; 20p; In Japanese; Original contains color illustrations

Report No.(s): PB2000-106826; NAL/TR-1403; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

To investigate the unsteady flow characteristics of the oscillating 2D wing, the authors developed an innovative mechanism to drive 2D wing models. The major design concepts of the system are: (1) quasi-harmonic pitching oscillation up to frequency of 8 Hz via 3 electric motors controlled by the personal computer, and (2) the mean-angles of attack, the amplitude and the frequencies can be changed automatically. The system is used for the flow visualization in a low wind tunnel to view the unsteady flow patterns around an oscillating 2D wing model.

NTIS

Oscillating Flow; Two Dimensional Models; Wings; Flow Characteristics; Flow Visualization; Harmonic Oscillation; Unsteady Flow

20000080527 NASA Glenn Research Center, Cleveland, OH USA

A Note on Trapping Moving Vortices

Kao, Hsiao C., NASA Glenn Research Center, USA; July 2000; 16p; In English

Contract(s)/Grant(s): RTOP 522-31-23

Report No.(s): NASA/TM-2000-209270; E-11720; NAS 1.15:209270; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The topic of stationary configurations of point vortices, also known as vortex equilibrium, has received considerable attention in recent years. By observing numerical results, it is found that a "counterpart" of this system also exists, in which moving vortices may be "trapped" by an inlet-like device to form a stationary pattern with no translational motion. After an intuitive explanation for the process, vortex trajectory maps based on numerical results are presented. These maps exhibit two stationary points under the present conditions, which are the focal points of vortex trajectories. A vortex upstream of these points, if within a certain offset range, will move towards these points spontaneously and be captured there. This proposed device is also capable of trapping spinning vortex pairs and triads. It is possible to impose a uniform stream at infinity, as long as the flow field is still dominated by the moving vortices.

Author

Trapping; Vortices; Vortex Sheets; Flow Distribution; Vorticity

20000081743 NASA Langley Research Center, Hampton, VA USA

Hyper-X Stage Separation Wind Tunnel Test Program

Woods, W. C., NASA Langley Research Center, USA; Holland, S. D., NASA Langley Research Center, USA; DiFulvio, M., NASA Langley Research Center, USA; [2000]; 20p; In English; 18th; 18th Applied Aerodynamics Conference, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4008; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA's Hyper-X research program was developed primarily to flight demonstrate a supersonic combustion ramjet engine, fully integrated with a forebody designed to tailor inlet flow conditions and a free expansion nozzle/afterbody to produce positive thrust at design flight conditions. With a point-designed propulsion system, the vehicle must depend upon some other means for

boost to its design flight condition. Clean separation from this initial propulsion system stage within less than a second is critical to the success of the flight. This paper discusses the early planning activity, background, and chronology that developed the series of wind tunnel tests to support multi degree of freedom simulation of the separation process. Representative results from each series of tests are presented and issues and concerns during the process and current status will be highlighted.

Author

Supersonic Combustion Ramjet Engines; Stage Separation; Propulsion System Configurations; Wind Tunnel Tests; Aircraft Structures; Inlet Flow; Hypersonic Aircraft; Launch Vehicle Configurations; Research Vehicles

20000082202 La Sapienza Univ., Rome, Italy

Proceedings of CEAS Forum on Aeroacoustics of Rotors and Propellers

Jun. 11, 1999; 204p; In English, 9-11 Jun. 1999, Rome, Italy

Contract(s)/Grant(s): N68171-99-M-5840

Report No.(s): AD-A379005; R/D-8734-AN-02; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The CEAS Forum on Aeroacoustics of Rotors and Propellers is intended to give a comprehensive survey of the state of the art in the field and to provide an opportunity to scientists and engineers from industry, research establishments and universities to present new results based on their recent studies, to exchange opinions and experiences, and to discuss directions of future research. The program's technical content will include theoretical, numerical, and experimental contributions that describe original research results and/or innovative design concepts. In addition, papers that provide in-depth reviews and timely surveys of appropriate subjects will be considered. Papers that cover all aspects of exterior aeroacoustics of rotors and propellers (including tilt rotors) are solicited. Also of interest are papers dealing with those aspects of aerodynamics and blade dynamics that are particularly relevant in the understanding of aeroacoustic phenomena, such as BVI (Blade Vortex Interaction). Indeed, of particular interest are those papers regarding comprehensive analyses of the BVI interplay of aeroacoustics with aerodynamics and blade dynamics. Although CEAS comprises aerospace societies, the Forum will not be limited to aeronautical applications (e.g., helicopter rotors, airplane propellers, tilt rotors). Hence, papers on related fields (e.g., wind turbines, fans, ship propellers) are also encouraged.

DTIC

Aeroacoustics; Conferences; Propellers; Aerodynamic Noise; Blade-Vortex Interaction; Rotary Wings; Rotor Aerodynamics

20000083072 Illinois Inst. of Tech., Fluid Dynamics Research Center, Chicago, IL USA

Investigation of Incipient Dynamic Stall at High Reynolds Numbers *Final Report, 15 Apr. 1994-31 Aug. 1997*

Acharya, Mukund, Illinois Inst. of Tech., USA; Kiedaisch, John W., Illinois Inst. of Tech., USA; Bizos, Angelis, Illinois Inst. of Tech., USA; Jan. 10, 2000; 201p; In English

Contract(s)/Grant(s): DAAH04-94-G-0069

Report No.(s): AD-A379036; ARO-32489.1-EG; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

In the first part of this study, surface shear-stress measurements were obtained on a NACA 0012 airfoil model, undergoing a pitch-up motion from 0 deg to 43 deg angle of attack at a constant rate using an array of surface-mounted hot-film sensors. Dominant features in these data and in the standard deviations computed from these data were examined and related to events in the development and evolution of the unsteady separation over the suction surface. Results were compared with well-known features of the dynamic stall process seen in the surface-pressure distributions. Trends in the behavior of these features are presented for a range of non-dimensional pitch rates and chord Reynolds numbers. Significant changes were seen in the behavior of these features at high Reynolds numbers. The results suggest that these changes are due to transition in the shear layer at high pitch rates and quasi-steady behavior at low pitch rates. In the second pan of this study, large amplitude sinusoidal motions were investigated for a wide range of Reynolds numbers and reduced frequencies. A combination of unsteady pressure and shear-stress data at the surface of the airfoil provided detailed information about the development and evolution of the flowfield. In particular, the formation of the dynamic stall vortex (DSV) during the upstroke of the motion profile was examined in detail as well as the reattachment process during the downstroke of the motion profile. Significant changes in behavior were seen with changing Reynolds number, reduced frequency, and amplitude of oscillation. The mean angle did not affect the development of the DSV except at the highest reduced frequency ($k=0.4$). Amplitude of oscillation did not affect the development of the reattachment process.

DTIC

Aerodynamic Stalling; High Reynolds Number; Frequencies; Unsteady Flow; Separated Flow

20000085864 NASA Langley Research Center, Hampton, VA USA

Computational Investigation of the Aerodynamic Effects on Fluidic Thrust Vectoring

Deere, K. A., NASA Langley Research Center, USA; [2000]; 16p; In English; 36th; 36th Joint Propulsion Conference and Exhibit,

17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3598; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computational investigation of the aerodynamic effects on fluidic thrust vectoring has been conducted. Three-dimensional simulations of a two-dimensional, convergent-divergent (2DCD) nozzle with fluidic injection for pitch vector control were run with the computational fluid dynamics code PAB using turbulence closure and linear Reynolds stress modeling. Simulations were computed with static freestream conditions ($M=0.05$) and at Mach numbers from $M=0.3$ to 1.2 , with scheduled nozzle pressure ratios (from 3.6 to 7.2) and secondary to primary total pressure ratios of $p(\text{sub } t,s)/p(\text{sub } t,p)=0.6$ and 1.0 . Results indicate that the freestream flow decreases vectoring performance and thrust efficiency compared with static (wind-off) conditions. The aerodynamic penalty to thrust vector angle ranged from 1.5 degrees at a nozzle pressure ratio of 6 with $M=0.9$ freestream conditions to 2.9 degrees at a nozzle pressure ratio of 5.2 with $M=0.7$ freestream conditions, compared to the same nozzle pressure ratios with static freestream conditions. The aerodynamic penalty to thrust ratio decreased from 4 percent to 0.8 percent as nozzle pressure ratio increased from 3.6 to 7.2 . As expected, the freestream flow had little influence on discharge coefficient.

Author

Computational Fluid Dynamics; Aerodynamics; Two Dimensional Flow; Convergent-Divergent Nozzles; Fluidics; Injection; Liquid Injection; Thrust Vector Control

20000085906 NASA Langley Research Center, Hampton, VA USA

Hyper-X Research Vehicle (HXR) Experimental Aerodynamics Test Program Overview

Holland, Scott D., NASA Langley Research Center, USA; Woods, William C., NASA Langley Research Center, USA; Englund, Walter C., NASA Langley Research Center, USA; [2000]; 14p; In English; 18th; 18th Applied Aeronautics Conference, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4011; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper provides an overview of the experimental aerodynamics test program to ensure mission success for the autonomous flight of the Hyper-X Research Vehicle (HXR). The HXR is a 12-ft long, 2700 lb lifting body technology demonstrator designed to flight demonstrate for the first time a fully airframe integrated scramjet propulsion system. Three flights are currently planned, two at Mach 7 and one at Mach 10 , beginning in the fall of 2000. The research vehicles will be boosted to the prescribed scramjet engine test point where they will separate from the booster, stabilize, and initiate engine test. Following $5+$ seconds of powered flight and 15 seconds of cowl-open tares, the cowl will close and the vehicle will fly a controlled deceleration trajectory which includes numerous control doublets for in-flight aerodynamic parameter identification. This paper reviews the preflight testing activities, wind tunnel models, test rationale, risk reduction activities, and sample results from wind tunnel tests supporting the flight trajectory of the HXR from hypersonic engine test point through subsonic flight termination.

Author

Hypersonics; Engine Tests; Research Vehicles; Supersonic Combustion Ramjet Engines; Hypersonic Speed; Flight Tests

20000088629 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan

Aircraft Fault Detection and Identification Using the Aerodynamic Model

Ruangwiset, Anop; Sakurai, Akira; Technology Reports of Kyushu University; May 2000; ISSN 0023-2718; Volume 73, No. 3, pp. 243-246; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

A fault on the aircraft such as damaged or lost control surfaces is the severe problem for the flight control system. The faster the fault can be detected and identified, the higher will be the probability that the vehicle can be saved. This paper presents a new approach using the aerodynamic model to detect and identify this kind of faults. The simulations have shown remarkable capabilities of this method.

Author

Fault Detection; Aircraft Models

20000088679 Rockwell International Corp., Thousand Oaks, CA USA

Basic Research for Coupled Multidisciplinary Computations Final Report, 29 Sep. 1995-30 Sep. 1999

Ramakrishnan, S. V., Rockwell International Corp., USA; Lee, K. H., Rockwell International Corp., USA; Sep. 30, 1999; 9p; In English

Contract(s)/Grant(s): DAAH04-95-C-0067

Report No.(s): AD-A379249; SC71116.RFRFTV; ARO-34781.1-EG; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

A methodology developed for multidisciplinary simulation of the trajectory of a propelled projectile maneuvered by deflecting the canards is presented. An approach to include the effect of the interaction between aerodynamics and structural

dynamics is demonstrated. The quasi-unsteady approach, briefly discussed here, has the potential to reduce the turnaround time by a factor of around 5 and thus substantially reduce the cost of simulating the trajectory of a projectile including the interaction between fluid dynamics, rigid-body dynamics and structural dynamics.

DTIC

Projectiles; Computerized Simulation; Canard Configurations; Dynamic Structural Analysis; Aerodynamics; Trajectories

20000089722 American MAGLEV, Inc., New Smyrna Beach, FL USA

Prediction of Lift and Drag Forces in an EDS Maglev System

Davey, Kent, American MAGLEV, Inc., USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 475-486; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document examines the tradeoffs of choosing a null flux excitation system versus a simple coil excitation. In both cases the guideway is considered to be a simple "O" shaped coil positioned vertically on the track. An analysis of both shows that the null flux excitation provides equivalent lift to the open coil system with less drag; further the lift is stabilizing in both directions for the null flux excitation. The full rectangular excitation coil proves to be excellent for guidance especially if the vehicle magnets/coils on either side are arranged in repulsion. The rectangular coils in attraction prove to be expensive for drag production and unable to produce downward restoring forces.

Author

Magnetic Suspension; Lift Drag Ratio; Magnetic Levitation Vehicles; Performance Prediction; Magnet Coils; Loads (Forces); Electrodynamics

20000089918 Naval Postgraduate School, Monterey, CA USA

A Computational and Experimental Investigation of Flapping-Wing Propulsion

Lund, Timothy C.; Mar. 2000; 80p; In English

Report No.(s): AD-A379263; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Flapping-wing propulsion is studied experimentally and numerically. The objective of the research is to provide further insight into the aerodynamics of flapping-wing air vehicles. Experimental work is conducted in the NPS 1.5 m x 1.5 m (5 ft x 5 ft) in-draft wind tunnel. A previously constructed long-span flapping-wing model suspended by cables is used to approximate the two-dimensional nature of the numerical simulation. For this experiment, the model is configured with two wings executing plunge-only motion. Thrust is indirectly determined by using a laser rangefinder to measure streamwise displacement of the model. Results are compared with previous experimental tests. A numerical analysis is conducted using USPOT, a locally developed unsteady panel code that models two independently moving airfoils with three degrees of freedom and non-linear deforming wakes. Thrust and efficiencies are computed for harmonically oscillating airfoils. Direct comparison is made between experimental and numerical thrust measurements.

DTIC

Wings; Aerodynamic Characteristics; Flaps (Control Surfaces); Mathematical Models; Numerical Analysis; Panel Method (Fluid Dynamics); Thrust Measurement; Aerodynamics; Airfoils

20000089922 Illinois Univ. at Urbana-Champaign, Dept. of Aeronautical and Astronautical Engineering, Urbana, IL USA

Effects of Large-Droplet Ice Accretion on Airfoil and Wing Aerodynamics and Control *Final Report*

Bragg, Michael B.; Loth, Eric; Apr. 2000; 195p; In English

Report No.(s): AD-A379331; DOT/FAA/AR-00/14; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

An integrated experimental and computational investigation was conducted to determine the effect of simulated ridge ice shapes on airfoil aerodynamics. These upper-surface shapes are representative of those which may form aft of protected surfaces in super-cooled large droplet conditions. The simulated ice shapes were experimentally tested on a modified National Advisory Committee for Aeronautics (NACA) 23012 (23012m) airfoil and Natural Laminar Flow (NLF) 0414 airfoil at Reynolds numbers of 1.8 million for a range of protuberance locations, sizes, and shapes. The computational study investigated the cases encompassed by the experimental study but in addition included higher Reynolds numbers and other airfoils from the NASA Commuter Airfoil Program.

DTIC

Ice Formation; Aerodynamics; Airfoils; Drop Size; Surface Reactions

20000089936 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Computation of The Free Surface Flow Around Lifting and Non-Lifting Bodies by a Mixed Potential and Velocity Based Boundary Element Method

Hsin, Ching-Yeh, National Taiwan Ocean Univ., Taiwan, Province of China; Chou, Shean-Kwang, United Ship Design and Development Centre, Taiwan, Province of China; Journal of the Chinese Institute of Engineering. Special Issue: Boundary Element Methods, 2; May 2000; ISSN 0253-3839; Volume 23, No. 3, pp. 331-338; In English; Copyright; Avail: Issuing Activity

The purpose of this paper is to present a mixed potential and velocity based boundary element method to solve wave making resist resistance problems. In this method, the singularity strength on a non-lifting body or a lifting body are solved by a potential based boundary element method, and the singularity strengths on the free surface are solved by a velocity based method. The interaction between the body and the free surface is then calculated by all iterative procedure. It is found that a block iterative matrix solver can be used in the solutions, and computational time has thus been dramatically reduced. Computational results are shown for the comparison of the presented method and a source only velocity based method. Calculated results for both non-lifting, and lifting bodies are also compared with the experimental data.

Author

Boundary Element Method; Free Flow; Lifting Bodies; Velocity; Solid Surfaces; Computation

20000091005 NASA Langley Research Center, Hampton, VA USA

Prediction of Hyper-X Stage Separation Aerodynamics Using CFD

Buning, Pieter G., NASA Langley Research Center, USA; Wong, Tin-Chee, FDC/NYMA, Inc., USA; Dilley, Arthur D., FDC/NYMA, Inc., USA; Pao, Jenn L., FDC/NYMA, Inc., USA; [2000]; 12p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4009; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA X-43 "Hyper-X" hypersonic research vehicle will be boosted to a Mach 7 flight test condition mounted on the nose of an Orbital Sciences Pegasus launch vehicle. The separation of the research vehicle from the Pegasus presents some unique aerodynamic problems, for which computational fluid dynamics has played a role in the analysis. This paper describes the use of several CFD methods for investigating the aerodynamics of the research and launch vehicles in close proximity. Specifically addressed are unsteady effects, aerodynamic database extrapolation, and differences between wind tunnel and flight environments.

Author

Performance Prediction; Hypersonic Vehicles; Launch Vehicles; Research Vehicles; Stage Separation

20000091591 NASA Langley Research Center, Hampton, VA USA

Research on the F/A-18E/F Using a 22%-Dynamically-Scaled Drop Model

Croom, M., NASA Langley Research Center, USA; Kenney, H., NASA Langley Research Center, USA; Murri, D., NASA Langley Research Center, USA; Lawson, K., Naval Air Systems Command, USA; [2000]; 16p; In English; Atmospheric Flight Mechanics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3913; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research on the F/A-18E/F configuration was conducted using a 22%-dynamically-scaled drop model to study flight dynamics in the subsonic regime. Several topics were investigated including longitudinal response, departure/spin resistance, developed spins and recoveries, and the failing leaf mode. Comparisons to full-scale flight test results were made and show the drop model strongly correlates to the airplane even under very dynamic conditions. The capability to use the drop model to expand on the information gained from full-scale flight testing is also discussed. Finally, a preliminary analysis of an unusual inclined spinning motion, dubbed the "cartwheel", is presented here for the first time.

Author

F-18 Aircraft; Aerodynamic Configurations; Full Scale Tests; Dynamic Models; Flight Mechanics; Flight Tests

20000092055 NASA Ames Research Center, Moffett Field, CA USA

The Evolution of the DARWIN System

Walton, Joan D., NASA Ames Research Center, USA; Filman, Robert E., NASA Ames Research Center, USA; Korsmeyer, David J., NASA Ames Research Center, USA; [1999]; 10p; In English; Applied Computing, 19-21 Mar. 2000, Como, Italy; Sponsored by Association for Computing Machinery, USA

Contract(s)/Grant(s): NAS2-14217; RTOP 519-10-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

DARWIN is a web-based system for presenting the results of wind-tunnel testing and computational model analyses to aerospace designers. DARWIN captures the data, maintains the information, and manages derived knowledge (e.g. visualizations,

etc.) of large quantities of aerospace data. In addition, it provides tools and an environment for distributed collaborative engineering. We are currently constructing the third version of the DARWIN software system. DARWIN's development history has, in some sense, tracked the development of web applications. The 1995 DARWIN reflected the latest web technologies--CGI scripts, Java applets and a three-layer architecture--available at that time. The 1997 version of DARWIN expanded on this base, making extensive use of a plethora of web technologies, including Java/JavaScript and Dynamic HTML. While more powerful, this multiplicity has proven to be a maintenance and development headache. The year 2000 version of DARWIN will provide a more stable and uniform foundation environment, composed primarily of Java mechanisms. In this paper, we discuss this evolution, comparing the strengths and weaknesses of the various architectural approaches and describing the lessons learned about building complex web applications.

Author

Internet Resources; Information Systems; On-Line Systems; Client Server Systems; Information Retrieval; Wind Tunnel Tests

~~200000~~92106 NASA Langley Research Center, Hampton, VA USA

The Modern Design of Experiments: A Technical and Marketing Framework

DeLoach, R., NASA Langley Research Center, USA; [2000]; 10p; In English; 21st; Advanced Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 2000-2691; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new wind tunnel testing process under development at NASA Langley Research Center, called Modern Design of Experiments (MDOE), differs from conventional wind tunnel testing techniques on a number of levels. Chief among these is that MDOE focuses on the generation of adequate prediction models rather than high-volume data collection. Some cultural issues attached to this and other distinctions between MDOE and conventional wind tunnel testing are addressed in this paper.

Author

Experiment Design; Mathematical Models; Wind Tunnel Tests

~~200000~~92515 NASA Langley Research Center, Hampton, VA USA

Aerodynamic Database Development for the Hyper-X Airframe Integrated Scramjet Propulsion Experiments

Engelund, Walter C., NASA Langley Research Center, USA; Holland, Scott D., NASA Langley Research Center, USA; Cockrell, Charles E., Jr., NASA Langley Research Center, USA; Bittner, Robert D., FDC/NYMA, Inc., USA; [2000]; 30p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 2000-4006; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper provides an overview of the activities associated with the aerodynamic database which is being developed in support of NASA's Hyper-X scramjet flight experiments. Three flight tests are planned as part of the Hyper-X program. Each will utilize a small, nonrecoverable research vehicle with an airframe integrated scramjet propulsion engine. The research vehicles will be individually rocket boosted to the scramjet engine test points at Mach 7 and Mach 10. The research vehicles will then separate from the first stage booster vehicle and the scramjet engine test will be conducted prior to the terminal decent phase of the flight. An overview is provided of the activities associated with the development of the Hyper-X aerodynamic database, including wind tunnel test activities and parallel CFD analysis efforts for all phases of the Hyper-X flight tests. A brief summary of the Hyper-X research vehicle aerodynamic characteristics is provided, including the direct and indirect effects of the airframe integrated scramjet propulsion system operation on the basic airframe stability and control characteristics. Brief comments on the planned post flight data analysis efforts are also included.

Author

Airframes; Computational Fluid Dynamics; Data Bases; Flight Tests; Supersonic Combustion Ramjet Engines; Aerodynamic Characteristics; Wind Tunnel Tests; Research Vehicles

~~200000~~93332 ZONA Technology, Inc., Scottsdale, AZ USA

Adaptive Reconfigurable Control Based on a Reduced Order System Identification for Flutter and Aeroservoelastic Instability Suppression *Final Report, 12 May 1999-12 Nov 2000*

Nam, C., ZONA Technology, Inc., USA; Chen, P. C., ZONA Technology, Inc., USA; Liu, D. D., ZONA Technology, Inc., USA; Yurkovich, R. M., Boeing Co., USA; Urnes, J., Boeing Co., USA; Jun. 19, 2000; 74p; In English; Prepared in cooperation with The Boeing Co., St. Louis, Mo.

Contract(s)/Grant(s): N68335-00-C-0126

Report No.(s): AD-A379722; ZONA-00-19; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the design of a reconfigurable adaptive control (RAC) system for flutter/aeroservoelasticity (ASE) instability suppression of battle-damaged aircraft and limit cycle oscillation (LCO) suppression of aircraft/store configurations.

With the F/A-18 as a baseline aircraft, rapid suppression of its critical damage/flutter and LCO (at 5.6 and 8.8 Hz) has been successfully demonstrated through eight cases of numerical simulations studied. The developed RAC system is a modular control design in that the flutter/LCO control can readily be combined with the rigid-body flight (RBF) control, thereby minimizing the impact on the existing flight control system for retrofit. The RAC system consists of a newly developed on-line modal parameter estimation (MPE) for system identification and on-line modified model-following reconfigurable (MMFR) algorithm for rapid flutter/LCO control (0.2 and 0.8 sec). A massive screening technique using an expedient nonlinear unsteady transonic method (ZTAIC) to generate plant matrices permits efficient identification of critical damage cases of flutter/ASE instability. Reduced-order techniques using proper orthogonal decomposition (POD) and minimum state (MIST) methods reduce the system to seven states. This allows the on-line algorithm to be operated within fractions of one second. The number of sensor locations are minimized to two at wing-tip for flutter/LCO control; and to four with two additional existing sensors in the fuselage for LCO/RBF dynamic control. Effective control surfaces for all cases considered are found to be the aileron and the trailing-edge flap rather than the leading edge flap. Essential tasks of phase II will be performed jointly with Boeing/St Louis with emphasis on nonlinear control analysis including actuator loading, control surface rates, 80Hz software update and software analysis for implementing LCO and flutter controllers in the FSFCC.

DTIC

Aircraft Configurations; Adaptive Control; System Identification; Aeroservoelasticity; F-18 Aircraft; Flutter; Dynamic Control; Flight Control

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation.

20000082844 Air Force Research Lab., Wright-Patterson AFB, OH USA

Investigation of Occupant Restraint Improvements to the SIIIS-3 Ejection Seat *Interim Report, Jun. 1998-Jan. 1999*

Pint, Steven M., Air Force Research Lab., USA; Perry, Chris E., Air Force Research Lab., USA; Jan. 1999; 21p; In English
Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A378913; AFRL-HE-WP-SR-2000-0002; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

During the Front Line Ejection Equipment Tests (FLEET) program, higher than anticipated radical values were recorded using the 103 lb Lightest Occupant In Service (LOIS) manikin ejecting in the SIIIS-3 ejection seat with and F-15 forebody. The radical value is calculated using the seat acceleration in the x and y axes, and the Dynamic Response (DR) in the z axis. It was observed that the LOIS manikin was poorly restrained in the seat regardless of the tension applied to the harness strap. Three concepts have been identified that can be readily incorporated into the seat to improve occupant restraint. These concepts are: an improved seat cushion using a conforming material, inertia reel rollers that are fixed with respect to the headbox, and inflatable elements attached to the lap-belt as pace fillers. Tests with manikins were performed to evaluate the proposed improvements. The large ADAM (218 lb) manikin and the LOIS manikin were subjected to impacts along the +z, -x, and +y axes using the AFRL Vertical Deceleration Tower (VDT) and Horizontal Impulse Accelerator (HIA). Test were conducted with the original seat configuration and with the proposed improvements incorporated into the seat Manikin response characteristics were measured and results were compared to determine the improvements provided by the modifications to the SIIIS ejection seat.

DTIC

Ejection Seats; Dynamic Response; F-15 Aircraft; Cushions; Escape Systems

20000083415 Federal Aviation Administration, Washington, DC USA

Specification: Performance Type One Local Area Augmentation System Ground Facility

Sep. 21, 1999; 122p

Report No.(s): PB2000-105837; FAA-E-2937; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This specification establishes the performance requirements for the Federal Aviation Administration (FAA) Performance Type (PT) 1 Local Area Augmentation System (LAAS) Ground Facility (LGF). Requirements contained within this specification are the basis to augment the Global Positioning System (GPS) to provide precision approach capability down to Category I minimums. The performance requirements are consistent with those requirements defined in the Requirements Document for the GPS Local Area Augmentation System (GPS/LAAS) (FAA, 1997), the Minimum Aviation System Performance Standards (MASPS) for the LAAS (RTCA/DO-245, 1998), and the Minimum Operational Performance Standards (MOPS) for the LAAS

(RTCA, draft version 14). The LGF is a safety-critical system consisting of the hardware and software that augments the GPS Standard Positioning Service (SPS) to provide for precision approach and landing capability in the USA National Airspace System (NAS).

NTIS

Global Positioning System; Aircraft Landing; Specifications; Augmentation

20000083947 Dayton Univ. Research Inst., Structural Integrity Div., OH USA

Statistical Loads Data for B-767-200ER Aircraft in Commercial Operations Final Report

Tipps, Daniel O.; Rustenburg, John W.; Skinn, Donald A.; Mar. 2000; 83p; In English

Contract(s)/Grant(s): DTFA03-98-F-IA002

Report No.(s): AD-A378308; URD-TR-99-00072; DOT/FAA/AR-00/10; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The University of Dayton is supporting Federal Aviation Administration (FAA) research on the structural integrity requirements for the U.S. commercial transport airplane fleet. The primary objective of this research is to support the FAA Airborne Data Monitoring Systems Research Program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The scope of activities performed involved (1) defining the service related factors which affect the operational life of commercial aircraft; (2) designing an efficient software system to reduce, store, and process large quantities of optical quick access recorder data; and (3) providing processed data in formats that will enable the FAA to reassess existing certification criteria. Equally important, these new data will also enable the FAA, the aircraft manufacturers, and the airlines to better understand and control those factors which influence the structural integrity of commercial transport aircraft. Presented herein are analyses and statistical summaries of data collected from 1285 flights representing 9164 flight hours of 10 typical B-767-200ER aircraft during operational usage recorded by a single airline. The data include statistical information on accelerations, speeds, altitudes, flight duration and distance, gross weights, speed brake/spoiler cycles, thrust reverser usage, and gust velocities encountered.

DTIC

Loads (Forces); Boeing 767 Aircraft; Aircraft Structures; Statistical Analysis; Data Systems; Commercial Aircraft

20000083981 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA

Aviation Safety: Safer Skies Initiative Has Taken Initial Steps to Reduce Accident Rates by 2007

Jul. 2000; 105p; In English

Report No.(s): AD-A379014; GAO/RCED-00-111; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The continued growth forecast for U.S. aviation in the coming decade will likely bring a rise in fatal accidents if the current accident rate is not reduced. Commercial aviation, used by most Americans when they fly, experienced an average of 6 fatal accidents a year in the USA in 1994-96; general aviation experienced an average of 380 a year. If the projected growth in flight hours occurs and the fatal accident rate is not reduced, GAO estimates in this report that the number of fatal commercial aviation accidents could rise to 9 per year and the number of fatal general aviation accidents to 484 by 2007. The Federal Aviation Administration (FAA), the Congress, and the aviation industry have acknowledged this potential danger and have recommended ways to address it. In 1997, two major commissions on aviation safety recommended reducing the nation's aviation accident rate by 80 percent by 2007. To meet this challenging goal, both the White House Commission on Aviation Safety and Security and the congressionally mandated National Civil Aviation Review Commission recommended that FAA and the aviation industry work together to identify and address the causes of fatal accidents. To unify government and industry efforts to reduce the accident rate by addressing the greatest threats to aviation safety, FAA announced the Safer Skies initiative in April 1998 with the broad initial goal of reducing the number of fatal accidents per million flight hours by 80 percent by 2007.

DTIC

Aircraft Accidents; Congressional Reports; General Aviation Aircraft; Aircraft Safety

20000085966 Massachusetts Inst. of Tech., Cambridge, MA USA

Performance Evaluation of Evasion Maneuvers for Parallel Approach Collision Avoidance

Winder, Lee F., Massachusetts Inst. of Tech., USA; Kuchar, James K., Massachusetts Inst. of Tech., USA; August 2000; 74p; In English

Contract(s)/Grant(s): NAG1-1974; RTOP 576-02-11-17

Report No.(s): NASA/CR-2000-210099; NAS 1.26:210099; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Current plans for independent instrument approaches to closely spaced parallel runways call for an automated pilot alerting system to ensure separation of aircraft in the case of a "blunder," or unexpected deviation from the a normal approach path.

Resolution advisories by this system would require the pilot of an endangered aircraft to perform a trained evasion maneuver. The potential performance of two evasion maneuvers, referred to as the "turn-climb" and "climb-only," was estimated using an experimental NASA alerting logic (AILS) and a computer simulation of relative trajectory scenarios between two aircraft. One aircraft was equipped with the NASA alerting system, and maneuvered accordingly. Observation of the rates of different types of alerting failure allowed judgement of evasion maneuver performance. System Operating Characteristic (SOC) curves were used to assess the benefit of alerting with each maneuver.

Author

Evaluation; Collision Avoidance; Computerized Simulation; Instrument Approach; Performance Tests

20000088590 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Composite Variable Formulations for Express Shipment Service Network Design

Armocost, Andrew P.; Jul. 17, 2000; 188p; In English

Report No.(s): AD-A379875; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

In this thesis, we consider large-scale network design problems, specifically the problem of designing the air network of an express shipment (i.e., overnight) delivery operation. We focus on simultaneously determining the route structure, the assignment of fleet types to routes, and the flow of packages on aircraft. Traditional formulations for network design involve modeling both flow decisions and design decisions explicitly. The bounds provided by their linear programming relaxations are often weak. Common solution strategies strengthen the bounds by adding cuts, but the sheer size of the express shipment problem results in models that are intractable. To overcome this shortcoming, we introduce a new modeling approach that 1) removes the flow variables as explicit decisions and embeds them within the design variables and 2) combines the design variables into composite variables, which represent the selection of multiple aircraft routes that cover the demands for some subset of commodities. The resulting composite variable formulation provides tighter bounds and enables very good solutions to be found quickly. We apply this type of formulation to the express shipment operations of the United Parcel Service (UPS). Compared with existing plans, the model produces a solution that reduces the number of required aircraft by almost 11 percent and total annual cost by almost 25 percent. This translates to potential annual savings in the hundreds of millions of dollars.

DTIC

Architecture (Computers); Air Transportation; Computer Networks; Routes

20000088601 Mitre Corp., McLean, VA USA

Safe Flight 21 Master Plan. Version 2.0

Apr. 2000; 108p; In English

Report No.(s): AD-A379929; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Safe Flight 21 is a cooperative Government/Industry effort to evaluate enhanced capabilities for Free Flight based on evolving Communications, Navigation, and Surveillance (CNS) technologies. Safe Flight 21 will demonstrate the in-cockpit display of traffic, weather, and terrain information for pilots and will provide improved information for controllers. The new technologies on which this program is based include Global Positioning System (GPS), Automated Dependent Surveillance - Broadcast (ADS-B), Flight Information Services (FIS), Traffic Information Service - Broadcast (TIS-B), and their integration with enhanced pilot and controller information displays. Safe Flight 21 will evaluate the safety, service, and procedures improvements that these technologies make possible. The purpose of this Master Plan is to present a Safe Flight 21 plan for incrementally specifying, developing, and evaluating the operational enhancements called for in the RTCA Joint Government/Industry Roadmap.

DTIC

Information Systems; Free Flight; Air Traffic; Display Devices

20000088632 Massachusetts Inst. of Tech., Transportation Center, Cambridge, MA USA

Planning and Control of Transportation Systems: Robust Airline Planning *Final Report, 1 Sep. 1998 - 30 Sep. 1999*

Barnhart, C.; May 10, 2000; 40p; In English

Contract(s)/Grant(s): DTRS95-G-0001

Report No.(s): PB2000-106422; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Airline operations are made up of many interdependent components. Both aircraft and crews are limited and costly resources. Aircraft are subject to strict maintenance rules; crews must follow complex FAA and union restrictions. Coupled together, they form a complex network over which passengers flow. Each planning decision, such as, the departure time of a flight, the type of aircraft flow, the pairing of flights for direct flights, can have a dramatic impact on other aspects of the system. Decisions are usually made with the expectation that they will cover an extended period where each day has the same schedule and fleeting. In reality, this is rarely the case. In addition to planned deviations (for example, additional flights in business markets on busier

days of the week), there is a vast array of unplanned daily deviations. These range from a crowded flight needing a few extra unplanned minutes to load and unload passengers, to weather-induced ground holds which may significantly delay departures of a large number of flights, to an aircraft being grounded for unplanned maintenance, to a crew member not being available for his or her planned flight. Deviations such as these can ripple throughout the system, causing wide-spread disruptions. The authors look at how robustness may be measured and incorporated in the airline planning phase. The authors' focus is on the fleet assignment problem, with some limited schedule adjustment. The authors focus on three different areas including the identification of metrics to measure how operations deviate from the plan and how this impacts the rest of the system; the development of tools for comparing different plans given the same scenario of operational conditions; and the existence of alternative approaches to the fleet assignment problem that encourage robustness.

NTIS

Planning; Airline Operations; Air Traffic Control; Flight Plans; Air Transportation; Systems Engineering; Human Factors Engineering

20000088661 Navy Technology Center for Safety and Survivability, Chemistry Div., Washington, DC, DC USA

Aircraft Hangar Fire Suppression System Design Study Interim Report

Scheffey, Joseph L., Hughes Associates, Inc., USA; Wakelin, Allison J., Hughes Associates, Inc., USA; Gott, Joseph E., Naval Facilities Engineering Command, USA; Tabet, Robert J., Naval Facilities Engineering Command, USA; Williams, Frederick W., Navy Technology Center for Safety and Survivability, USA; Jun. 16, 2000; 88p; In English

Report No.(s): AD-A379632; NRL/MR/6180--00-8464; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Navy and other military service branches within the Department of Defense are responsible for the fire protection of Department of Defense assets. These assets include high value military aircraft that are maintained and repaired in high bay aircraft hangars. These aircraft are essential elements of a strategic military force whose mission is unparalleled by commercial aircraft. Previously, the Navy adopted fire protection standards embodied in industry standards for commercial aircraft protection. However, over time the Navy recognized the unique considerations that should be given to protecting vital assets, and that these considerations were not adequately addressed in the standards they were adopting. The Navy identified a fundamental performance goal for its hangar fire protection systems. This goal was the installation of a reliable and easily maintained fire protection system, which prevents damage to the hangar structure and to the aircraft not directly involved in an initial spill fire ignition scenario. This resulted in a multi-year study to address all technical issues associated with meeting this goal.

DTIC

Fire Prevention; Hangars; Aircraft Maintenance; Safety Management

20000088666 Naval Postgraduate School, Monterey, CA USA

An Evaluation of the Aviation Maintenance Climate Assessment Survey (MCAS), Applied to the 3rd Marine Air Wing
Harris, Christopher A.; Jun. 2000; 94p; In English

Report No.(s): AD-A379517; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Faced with aging aircraft and fewer acquisitions, Naval Aviation has redoubled its effort to preserve assets through preventative maintenance and reduction of aircraft mishaps. Eighty percent of all mishaps are due in part to human error, and approximately one out of five major mishaps are due to maintainer, line, or facility related factors. Among various efforts to systematically reduce mishaps is the use of the Maintenance Climate Assessment Survey (MCAS). This survey is designed to capture maintainer perceptions of safety. This thesis analyzes the results of 977 responses to MCAS given to the 3rd Marine Air Wing (MAW) maintenance personnel. In addition, it explores the MCAS's relationship with human errors present in 21 maintenance-related incidents (MRIs) using the Human Factors Analysis and Classification System - Maintenance Extension. This analysis finds statistically different responses among the squadrons of the 3rd MAW to the MCAS. These differences show the MCAS can detect variations between aviation units and associated Model of Organization Safety Effectiveness components. While no significant correlation between the nine adequately surveyed squadrons and their MRIs is found, a content analysis of the MCAS shows there is a relationship between the MRIs a squadron experiences and the items of the six MOSE components.

DTIC

Aircraft Maintenance; Human Factors Engineering; Aircraft Accidents

20000088689 Mitre Corp., McLean, VA USA

Safe Flight 21 Master Plan Version 2.0, Version 2.0

Apr. 2000; 108p; In English

Report No.(s): AD-A379459; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Safe Flight 21 is a cooperative government/industry effort to evaluate enhanced capabilities for Free flight based on evolving Communications, Navigation and Surveillance (CNS) technologies. Safe Flight 21 will demonstrate the in-cockpit display of traffic, weather and terrain information for pilots and will provide improved information for controllers. The new technologies on which this program is based include the Global Positioning System (GPS), Automated Dependent Surveillance - Broadcast (ADS-B), Flight Information Services (HS), Traffic Information Service - Broadcast (TIS-B), and their integration with enhanced pilot and controller information displays. Safe Flight 21 will evaluate the safety, service and procedure improvements these technologies make possible. Safe Flight 21 is a cooperative government/industry effort to evaluate enhanced capabilities for Free flight based on evolving Communications, Navigation and Surveillance (CNS) technologies. Safe Flight 21 will demonstrate the in-cockpit display of traffic, weather and terrain information for pilots and will provide improved information for controllers. The new technologies on which this program is based include the Global Positioning System (GPS), Automated Dependent Surveillance - Broadcast (ADS-B), Flight Information Services (HS), Traffic Information Service - Broadcast (TIS-B), and their integration with enhanced pilot and controller information displays. Safe Flight 21 will evaluate the safety, service and procedure improvements these technologies make possible.

DTIC

Flight Plans; Flight Safety; Free Flight

20000089873 Indiana Univ., Bloomington, IN USA

Skyteam: A Strategic Alliance

Pennington, Leon E.; Aug. 2000; 118p; In English

Report No.(s): AD-A379956; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This paper began with a brief history of the development of the airplane and the airline industry in the USA and Europe. Use of aircraft for mail delivery and passenger travel was discussed as well as political environments and stages of development which led to the emergence of airlines themselves. As airlines developed and international travel became common, international political considerations of this activity were examined. This activity impacted the development of use of strategic alliances in the airline industry. Market-based economics were discussed, and the permitted level of cooperative effort among the airlines was examined from a historical and current point of view. to determine the impact of strategic alliances in the air transport industry, a detailed examination of the structure and operational aspects of two member airlines in a newly formed alliance was conducted using historical and current information from industry sources in English and French. Each member airline, Delta Air Lines, and Air France, was examined with comparative reasoning in order to evaluate their operations in a standardized fashion. The analysis chapter, an evaluation of the effectiveness of the strategic alliances the member airlines had formed, was conducted using objective, industry-wide criteria. This analysis led to a conclusion that strategic alliances in the air transport industry are beneficial and essential to provide an Anywhere to Everywhere service to customers.

DTIC

Histories; Strategy; Aircraft Industry; USA; Europe; Civil Aviation

20000089926 Army Safety Center, Fort Rucker, AL USA

Flightfax: Army Aviation Risk-Management Information, Volume 28, No 7

Jul. 2000; 16p; In English

Report No.(s): AD-A379408; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

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DTIC

Accident Prevention; Aircraft Accidents; Aircraft Safety

20000089956 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory. Study of Obstacle Detection by Integrating Kinematic GPS with Camera Images for Taxi Guidance

Kato, T.; Harigae, M.; Tsujii, T.; Murata, M.; Nov. 1999; 60p; In Japanese

Report No.(s): PB2000-106823; NAL/TR-1395; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Achieving more efficient traffic control and improved flight safety in and around airports are among the most important issues for aeronautical engineering. For this purpose, it is essential to realize the free flight led by an autonomous air traffic control with a collision avoidance function and the highly precise satellite navigation that enables airplanes to make instrumental landings that meet the category III C standard. Focusing on the taxi guidance phase in which an airplane taxis on a taxi-way, this report deals with how to build a navigation system which not only precisely measures the airplane's position but also detects obstacles in its

path to avoid collision. This system combines satellite navigation (kinematic GPS) with camera images. The idea is to detect obstacles by calculating the difference between the information produced by the synthetic vision of the kinematic GPS and that produced by the camera images. This is the first study to propose this type of method for detecting obstacles. Carrying the system, an airplane will be capable of the autonomous traffic control and management in the taxi guidance, detecting obstacles in its way and measuring their position (both in terms of distance and direction) relative to itself.

NTIS

Global Positioning System; Air Traffic Control; Air Navigation; Automatic Control; Navigation

~~20000091041~~ Federal Aviation Administration, Fire Safety Section, Atlantic City, NJ USA

Aircraft Materials Fire Test Handbook Final Report

Horner, April, Compiler; Apr. 2000; 235p; In English

Report No.(s): AD-A379271; DOT/FAA/AR-00/12; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The purpose of the Aircraft Materials Fire Test Handbook is to describe all FAA-required fire test methods for aircraft materials in a consistent and detailed format. The handbook provides information to enable the user to assemble and properly use the test methods. Moreover, to broaden the utility of the handbook, the appendices contain the following information: FAA fire safety regulations, FAA approval process, aircraft materials, regulatory methodology used by other countries, aircraft industry internal test methods and guidelines, laboratories actively using fire test methods, and commercial manufacturers of fire test equipment.

DTIC

Aircraft Maintenance; Handbooks; Aircraft Safety; Fire Prevention; Regulations

~~20000091042~~ Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

Prevalence of Drugs and Alcohol in Fatal Civil Aviation Accidents Between 1994 and 1998 Final Report

Canfield, Dennis V., Civil Aeromedical Inst., USA; Hordinsky, Jerry, Civil Aeromedical Inst., USA; Millett, David P, Federal Aviation Administration, USA; Endecott, Boyd, Civil Aeromedical Inst., USA; Smith, Dudley, Civil Aeromedical Inst., USA; Jun. 2000; 9p; In English

Report No.(s): AD-A379272; DOT/FAA/AM-00/21; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The use of drugs and alcohol in aviation is closely monitored by the FAA Office of Aviation Medicine's (OAM's) Civil Aeromedical Institute (CAMI) through the toxicological analysis of specimens from pilots who have died in aviation accidents. This information on the use of drugs in aviation is helpful to the FAA in developing programs to reduce the usage of dangerous drugs and identify potentially incapacitating medical conditions that may cause an accident. Data collected from this research can be used to evaluate the effectiveness of the FAA drug testing program. The toxicology reports prepared by the CAMI Forensic Toxicology Research Section are used by the FAA and the National Transportation Safety Board to determine the cause of aviation accidents. Specimens (blood, urine, liver, kidney, vitreous fluid, and other bodily specimens) were collected by pathologists near the accident and placed in evidence containers provided by CAMI. These samples were refrigerated and shipped by overnight air. Upon receipt, the specimens were inventoried and accessioned for the analysis of drugs, alcohol, carbon monoxide, and cyanide. All data collected by the laboratory were entered into a computer database for future analysis. The database was searched using a Microsoft Access TM program developed by a local contractor. The database was sorted based on the class of drug, controlled dangerous substance schedules I and II, controlled dangerous substance schedules III-V, prescription drugs, over-the-counter drugs, and alcohol. The Toxicology and Accident Research laboratory received specimens from 1683 pilots for postmortem toxicology analysis between 1994 to 1998. Controlled dangerous substances, CDS, (schedules I and II) were found in 89 of the pilots analysed. Controlled dangerous substances (schedules III - V) were found in 49 of the pilots tested. Prescription drugs were found in 240 of the pilots analyzed. Over-the-counter drugs were found in 301 of the pilots analysed. c

DTIC

Drugs; Toxicology; Alcohols; Blood Volume; Aircraft Accidents; Safety Management

~~20000092489~~ University of Central Florida, Dept. of Industrial Engineering and Management Systems, Orlando, FL USA

Examining Low-Cost Simulation and Situational Awareness Assessment in Army Aviation Applications

Donovan, Sharlene Joy, University of Central Florida, USA; Jan. 2000; 117p; In English

Report No.(s): AD-A379841; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The concept of using simulation for training is not new in the aviation experience. Flight simulators have been in existence since the early 1920s and have evolved from non-mechanical, tethered aircraft to high fidelity, multi-million dollar motion platforms. In the demanding and dynamic environment of aviation, errors can be catastrophic. It is not surprising that both the civilian and military communities have made simulation training a critical component of their aviation training programs. Despite

the wide variety of simulation training efforts being pursued by military and civilian aviation alike, there is limited research on the subject of low-cost team training, particularly in the area of situation awareness. Most research has been directed toward individual task performance. Only in recent years has additional emphasis been placed on crew resource management (CRM). Even less literature exists on the concept of aircraft to aircraft team training an intercockpit training model as opposed to an infracockpit training model. Simulation being used by the U.S. Army that is team based focuses mostly on commander and battle staff training. There is a clear lack of research concerning the suitability of using low-cost simulation for training U.S. Army aviators in team collective tasks and situational awareness (SA). The purpose of this research is to develop an assessment tool and conceptual model, tailored to emulate Army aviation platforms, that can be used in an situational awareness training goals. Lessons learned and areas for future research are also discussed.

DTIC

Flight Simulators; Human Performance; Flight Training; Aircraft Pilots; Computerized Simulation

20000093311 Civil Aeromedical Inst., Oklahoma City, OK USA

Controlled Flight Into Terrain: A Study of Pilot Perspectives in Alaska *Final Report*

Bailey, Larry L., Civil Aeromedical Inst., USA; Peterson, Linda M., Civil Aeromedical Inst., USA; Williams, Kevin W., Civil Aeromedical Inst., USA; Thompson, Richard C., Civil Aeromedical Inst., USA; August 2000; 52p; In English
Report No.(s): DOT/FAA/AM-00/28; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the results of a survey designed to identify pilot and organizational risk factors of having a controlled flight into terrain (CFIT) accident in Alaska. The population consisted of commercial (passenger and freight) Alaskan pilots who operated under Parts 135, 133, 125 and/or 121 Federal Aviation Regulations (FARs). A 103-item questionnaire was developed covering the following domains: (1) organizational influences, (2) unsafe supervision, (3) preconditions for unsafe pilot acts, and (4) unsafe pilot acts. Pilots were pre-coded into one of two groups based on whether their current employer had experienced a CFIT accident within a five-year period (1992-1997). Response rates across both groups were 20% and although lower than desired, it was not unusual for surveys of this nature. Survey results revealed that having to fly in marginal weather conditions was a common experience for all respondents. However, pilots who worked for companies who had a CFIT accident rated their company's safety climate and practices significantly lower than pilots who worked for CFIT accident free companies. Based on the survey results and considering the findings of the Aviation Safety in Alaska report (National Transportation Safety Board, 1995) the following recommendations were developed to reduce the number of CFIT accidents in Alaska: (1) increase pilot awareness of CFIT safety-related issues, (2) improve company safety culture, (3) improve pilot training in the environment in which they commonly fly, (4) improve weather briefings, and (5) eliminate pressure to complete a flight.

Author

Flight Control; Terrain; Aircraft Pilots; Alaska; Aircraft Accidents; Human Factors Engineering

20000094003 Civil Aeromedical Inst., Oklahoma City, OK USA

A Unique Contact Lens-Related Airline Aircraft Accident *Final Report*

Nakagawara, Van B., Civil Aeromedical Inst., USA; Veronneau, Stephen J. H., Civil Aeromedical Inst., USA; May 2000; 10p; In English

Contract(s)/Grant(s): AM-A-99-TOX-203

Report No.(s): DOT/FAA/AM-00/18; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The use of contact lenses to satisfy the distant visual acuity requirements for obtaining a civil airman medical certificate has been permitted since 1976. According to the Federal Aviation Administration's "Guide for Aviation Medical Examiners," the use of monovision contact lenses is not considered acceptable for aviation duties. An aviation accident involving the use of monovision contact lenses will be reviewed. A case report is presented utilizing information from a National Transportation Safety Board (NTSB) aircraft accident report (NTSB/AAR-97/03) of a non-fatal scheduled airline accident. Past studies that examined the use of contact lenses in the aviation environment are reviewed. On October 19, 1996, a McDonnell Douglas MD-88 aircraft, Delta Airlines Flight 554, was substantially damaged in an undershoot approach while landing at LaGuardia Airport, Flushing, NY. Weather observations indicated a broken cloud layer at 800 feet, visibility between 1/2 and 1 mile in heavy rain and fog or mist, and easterly winds at 12 to 14 knots. The approach was over water to Runway 13 and the flight crew transitioned to visual references just above the decision height. As the airplane continued to descend, it struck an approach light structure and the end of the runway deck, shearing off the main landing gear and slid 2,700 feet down the runway. During an emergency evacuation, 3 passengers received minor injuries. The NTS B determined that the probable cause of this accident was the inability of the pilot to overcome his misperception of the airplane's position relative to the runway, due to the use of monovision contact lenses. The

adverse effects of wearing contact lenses in the aviation environment are discussed. Research is recommended to better understand the effects of environmental conditions on monovision to validate the current policy on such corrections.

Author

Aerospace Medicine; Contact Lenses; Correction; Flight Crews; Flushing; Injuries; Safety Management; Visual Acuity

~~20000094021~~ Civil Aeromedical Inst., Oklahoma City, OK USA

Priorities, Organization, and Sources of Information Accessed by Pilots in Various Phases of Flight *Final Report*

Schvaneveldt, Roger, New Mexico State Univ., USA; Beringer, Dennis B., Civil Aeromedical Inst., USA; Lamonica, John, Lamonica Aviation, USA; Tucker, Richard, Air Force Research Lab., USA; Nance, Christopher, New Mexico State Univ., USA; July 2000; 48p; In English

Contract(s)/Grant(s): FAA-AM-A-98-HRR-510; B98-G-019

Report No.(s): DOT/FAA/AM-00/26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the first project of the study, 27 pilots rated the priority of information required for flight. These pilots were divided by flight experience into novices (65 to 820 hours' flight time) and experienced pilots (1600 to 17,000 hours' flight time). Participants rated 29 information elements across seven phases of flight. These data show the shifting priorities of information across phases of flight, and some clear differences in priority assignments appeared between the novices and the experienced pilots. In the second project, 34 pilots, some from Project 1, participated in the collection of relatedness data for 231 pairs of information elements. A Pathfinder analysis and hierarchical clustering were conducted showing connections among these elements and grouping of the elements. Pilot experience had little influence on the form of the network of associations. The discussion explores the potential of these data for instrumentation layout and integration of cockpit information systems, datalink design, and development of flight instruction curricula.

Author

Aircraft Pilots; Information Systems; Priorities; Flight Plans; Flight Paths

~~20000094283~~ General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA

Reagan National Airport Limited Opportunities to Improve Airlines' Compliance With Noise Abatement Procedures

Jun. 2000; 35p; In English

Report No.(s): AD-A380240; GAO/RCED-00-74; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A continuing concern of communities located near commercial airports is the amount of noise generated by aircraft during takeoffs and landings. At Ronald Reagan Washington National Airport (Reagan National), the takeoff and landing paths generally follow the Potomac River north and south of the airport. In the early 1980s, residents of Maryland, Virginia, and Washington, D.C., who live along the river urged the Federal Aviation Administration (FAA) to change Reagan National's arrival and departure routes. After testing various alternative departure routes and receiving negative public reaction, FAA restored the original flight paths. Since then, local groups have expressed concern primarily about how FAA and the Metropolitan Washington Airports Authority (MWAA), which operates Reagan National, interpret and apply the local procedures and federal laws that may affect aircraft noise for flights to and from the airport.

DTIC

Aircraft Noise; Noise Reduction; Flight Paths; Noise Pollution; Airports

~~20000094364~~ Vigyan Research Associates, Inc., Hampton, VA USA

Atmospheric Boundary Layer Wind Data During the Period January 1, 1998 Through January 31, 1999 at the Dallas-Fort Worth Airport, Volume I, Quality Assessment

Zak, J. Allen, Vigyan Research Associates, Inc., USA; Rodgers, William G., Jr., Lockheed Martin Engineering and Sciences Co., USA; August 2000; 22p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 576-02-11-11

Report No.(s): NASA/CR-2000-210323/VOL1; NAS 1.26:210323/VOL1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The quality of the Aircraft Vortex Spacing System (AVOSS) is critically dependent on representative wind profiles in the atmospheric boundary layer. These winds observed from a number of sensor systems around the Dallas-Fort Worth airport were combined into single vertical wind profiles by an algorithm developed and implemented by MIT Lincoln Laboratory. This process, called the AVOSS Winds Analysis System (AWAS), is used by AVOSS for wake corridor predictions. During times when AWAS solutions were available, the quality of the resultant wind profiles and variance was judged from a series of plots combining all sensor observations and AWAS profiles during the period 1200 to 0400 UTC daily. First, input data was evaluated for continuity and consistency from criteria established. Next, the degree of agreement among all wind sensor systems was noted and cases of

disagreement identified. Finally, the resultant AWAS solution was compared to the quality-assessed input data. When profiles differed by a specified amount from valid sensor consensus winds, times and altitudes were flagged. Volume one documents the process and quality of input sensor data. Volume two documents the data processing/sorting process and provides the resultant flagged files.

Derived from text

Atmospheric Boundary Layer; Wind Profiles; Aircraft Approach Spacing

20000094365 Vigyan Research Associates, Inc., Hampton, VA USA

Atmospheric Boundary Layer Wind Data During the Period January 1, 1998 Through January 21, 1999 at the Dallas-Fort Worth Airport, Volume 2, Data and Processing, 1 Jan. 1998 - 31 Jan. 1999

Zak, J. Allen, Vigyan Research Associates, Inc., USA; Rodgers, William G., Jr., Lockheed Martin Engineering and Sciences Co., USA; August 2000; 232p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 576-02-11-11

Report No.(s): NASA/CR-2000-210323/VOL2; NAS 1.26:210323/VOL2; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The NASA Langley Research Center's Aircraft Vortex Spacing System (AVOSS) requires accurate winds and turbulence to determine aircraft wake vortex behavior near the ground. Volume 1 described the wind input and quality analysis process. This volume documents the data available during the period January 1998 through January 1999 and the partitioning and concatenation of files for time of day, turbulence, non duplication, cross wind profile quality and ceiling and visibility. It provides the resultant filtered files for the first three partitions as well as identification of ceiling/visibility conditions when they were below 5000 feet and 5 miles respectively. It also includes the wind profile quality flags to permit automatic selection of files for AVOSS application using selected ceiling/visibility and wind profile quality values and flags (or no flags).

Author

Airports; Atmospheric Boundary Layer; Wind Profiles; Data Processing; Wind Measurement; Wind Variations

20000094366 Massachusetts Inst. of Tech., International Center for Air Transportation, Cambridge, MA USA

Aircraft Conflict Analysis and Real-Time Conflict Probing Using Probabilistic Trajectory Modeling Final Report

Yang, Lee C., Massachusetts Inst. of Tech., USA; Kuchar, James K., Massachusetts Inst. of Tech., USA; May 2000; 216p; In English

Contract(s)/Grant(s): NAG2-1111

Report No.(s): ICAT-2000-2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Methods for maintaining separation between aircraft in the current airspace system have been built from a foundation of structured routes and evolved procedures. However, as the airspace becomes more congested and the chance of failures or operational error become more problematic, automated conflict alerting systems have been proposed to help provide decision support and to serve as traffic monitoring aids. The problem of conflict detection and resolution has been tackled from a number of different ways, but in this thesis, it is recast as a problem of prediction in the presence of uncertainties. Much of the focus is concentrated on the errors and uncertainties from the working trajectory model used to estimate future aircraft positions. The more accurate the prediction, the more likely an ideal (no false alarms, no missed detections) alerting system can be designed. Additional insights into the problem were brought forth by a review of current operational and developmental approaches found in the literature. An iterative, trial and error approach to threshold design was identified. When examined from a probabilistic perspective, the threshold parameters were found to be a surrogate to probabilistic performance measures. To overcome the limitations in the current iterative design method, a new direct approach is presented where the performance measures are directly computed and used to perform the alerting decisions. The methodology is shown to handle complex encounter situations (3-D, multi-aircraft, multi-intent, with uncertainties) with relative ease. Utilizing a Monte Carlo approach, a method was devised to perform the probabilistic computations in near realtime. Not only does this greatly increase the method's potential as an analytical tool, but it also opens up the possibility for use as a real-time conflict alerting probe. A prototype alerting logic was developed and has been utilized in several NASA Ames Research Center experimental studies.

Author

Automatic Control; Failure; False Alarms

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control.

20000081747 NASA Goddard Space Flight Center, Greenbelt, MD USA

Preliminary Results from the GPS-Reflections Mediterranean Balloon Experiment (GPSR MEBEX)

Garrison, James L., NASA Goddard Space Flight Center, USA; Ruffini, Giulio, Institut d'Estudis Espancials de Catalunya, Spain; Rius, Antonio, Institut d'Estudis Espancials de Catalunya, Spain; Cardellach, Estelle, Institut d'Estudis Espancials de Catalunya, Spain; Masters, Dallas, Colorado Univ., USA; Armathys, Michael, Colorado Univ., USA; Zavorotny, Valery, Colorado Univ., USA; [2000]; 19p; In English; 6th; 6th International Conference on Remote Sensing Marine and Coastal Environment, 1-3 May 2000, Charleston, SC, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment to collect bistatically scattered GPS signals from a balloon at 37 km altitude has been conducted. This experiment represented the highest altitude to date that such signals were successfully recorded. The flight took place in August 1999 over the Mediterranean sea, between a launch in Sicily and recovery near Nerpio, a town in the Sierra de Segura, Albacete province of Huelva, Spain. Results from this experiment are presented, showing the waveform shape as compared to theoretical calculations. These results will be used to validate analytical models which form the basis of wind vector retrieval algorithms. These algorithms are already being validated from aircraft altitudes, but may be applied to data from future spaceborne GPS receivers. Surface wind data from radiosondes were used for comparison. This experiment was a cooperative project between NASA, the IEEC in Barcelona, and the University of Colorado at Boulder.

Author

Global Positioning System; Receivers; Experiment Design; Data Reduction

20000083188 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Global Positioning System (GPS) Error Source Prediction

Ferguson, Marcus G.; Mar. 2000; 64p; In English

Report No.(s): AD-A378287; AFIT/GOR/ENS/00M-12; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

With the initiation of the navigation accuracy prediction algorithm used to estimate the amount of GPS solution (location and time) error for receivers, the capability to accurately predict solution errors due to the major GPS error sources is growing. Although some sources of error within the GPS solution have been previously analyzed, modeled, and/or accounted for within various modeling efforts, a formal evaluation of the seven major error sources that distort GPS activity has not been officially conducted up until this point. This research offers a logical assessment of all the major GPS error sources and their definitive impact on the end user. This research describes the major error sources in the GPS solution, which includes error sources from the spacecraft propagation of the signal through space, and receiver errors for a representative family of receivers. Once we define these error sources, we prioritize these sources with respect to benefit-to-cost ratios. We base the benefit-to-cost ratio on an error's accountability to the modeling effort required. This research recommends a prioritized order of future enhancements for error source implementation and improvements in future GPS accuracy prediction models, with a complete explanation of the tradeoffs associated with each improvement.

DTIC

Global Positioning System; Errors

20000084161 NASA Goddard Space Flight Center, Greenbelt, MD USA

On Fast Post-Processing of Global Positioning System Simulator Truth Data and Receiver Measurements and Solutions Data

Kizhner, Semion, NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; 13th; Global Positioning System, 19-22 Sep. 2000, Salt Lake City, UT, USA; Sponsored by American Inst. of Navigation, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Post-processing of data, related to a GPS receiver test in a GPS simulator and test facility, is an important step towards qualifying a receiver for space flight. Although the GPS simulator provides all the parameters needed to analyze a simulation, as well as excellent analysis tools on the simulator workstation, post-processing is not a GPS simulator or receiver function alone, and it must be planned as a separate pre-flight test program requirement. A GPS simulator is a critical resource, and it is desirable to move off the pertinent test data from the simulator as soon as a test is completed. The receiver and simulator databases are used to extract the test data files for postprocessing. These files are then usually moved from the simulator and receiver systems to a personal computer (PC) platform, where post-processing is done typically using PC-based commercial software languages and

tools. Because of commercial software systems generality their functions are notoriously slow and more than often are the bottleneck even for short duration simulator-based tests. There is a need to do post-processing faster and within an hour after test completion, including all required operations on the simulator and receiver to prepare and move off the post-processing files. This is especially significant in order to use the previous test feedback for the next simulation setup or to run near back-to-back simulation scenarios. Solving the post-processing timing problem is critical for a pre-flight test program success. Towards this goal an approach was developed that allows to speed-up post-processing by an order of a magnitude. It is based on improving the post-processing bottleneck function algorithm using a priori information that is specific to a GPS simulation application and using only the necessary volume of truth data. The presented postprocessing scheme was used in support of a few successful space flight missions carrying GPS receivers.

Author

Simulators; Receivers; Global Positioning System; Flight Tests; Feedback; Data Bases

20000084167 Lockheed Martin Space Operations, Communications and Tracking Analysis Group, Houston, TX USA

Space Station GPS Multipath Analysis and Validation

Hwu, Shian U., Lockheed Martin Space Operations, USA; Loh, Y. C., Lockheed Martin Space Operations, USA; May 1999; 5p; In English; Vehicular Technology, 17-21 May 1999, Houston, TX, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NAS9-19100; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To investigate the multipath effects on the International Space Station (ISS) Global Positioning System (GPS) measurement accuracy, experimental and computational investigations were performed to estimate the carrier phase errors due to multipath. A new modeling approach is used to reduce the required computing time by separating the dynamic structure elements from the static structure elements in the multipath computations. This study confirmed that the multipath is a major error source to the ISS GPS performance and can possibly degrade the attitude determination solution. It is demonstrated that the GPS antenna carrier phase errors due to multipath can be analyzed using the electromagnetic modeling technique such as the Uniform Geometrical Theory of Diffraction (UTD).

Author

Global Positioning System; Multipath Transmission; Conferences; Space Navigation

20000085896 NASA Langley Research Center, Hampton, VA USA

NASA Research For Instrument Approaches to Closely Spaced Parallel Runways

Elliott, Dawn M., NASA Langley Research Center, USA; Perry, R. Brad, NASA Langley Research Center, USA; [2000]; 12p; In English; Guidance, Navigation, and Control Conference and Exhibit, 14-17 Aug. 2000, Denver, CO, USA

Report No.(s): AIAA Paper 2000-4358; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Within the NASA Aviation Systems Capacity Program, the Terminal Area Productivity (TAP) Project is addressing airport capacity enhancements during instrument meteorological condition (IMC). The Airborne Information for Lateral Spacing (AILS) research within TAP has focused on an airborne centered approach for independent instrument approaches to closely spaced parallel runways using Differential Global Positioning System (DGPS) and Automatic Dependent Surveillance-Broadcast (ADS-B) technologies. NASA Langley Research Center (LaRC), working in partnership with Honeywell, Inc., completed in AILS simulation study, flight test, and demonstration in 1999 examining normal approaches and potential collision scenarios to runways with separation distances of 3,400 and 2,500 feet. The results of the flight test and demonstration validate the simulation study.

Author

Instrument Approach; Global Positioning System; Flight Tests; Collisions

20000091035 NASA Goddard Space Flight Center, Greenbelt, MD USA

Preliminary Results from the GPS-Reflections Mediterranean Balloon Experiment (GPSR-MEBEX)

Garrison, James L., NASA Goddard Space Flight Center, USA; Ruffini, Giulio, Consejo Superior de Investigaciones Cientificas, Spain; Rius, Antonio, Consejo Superior de Investigaciones Cientificas, Spain; Cardellach, Estelle, Consejo Superior de Investigaciones Cientificas, Spain; Masters, Dallas, Colorado Univ., USA; Armatys, Michael, Colorado Univ., USA; Zavorotny, Valery, Colorado Univ., USA; [2000]; 19p; In English; 6th Remote Sensing for Marine and Coastal Environments, 1-3 May 2000, Charleston, SC, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment to collect bistatically scattered GPS signals from a balloon at 37 km altitude has been conducted. This experiment represented the highest altitude to date that such signals were successfully recorded. The flight took place in August 1999 over the Mediterranean sea, between a launch in Sicily and recovery near Nerpio, a town in the Sierra de Segura, Albacete

province of Huelva, Spain. Results from this experiment are presented, showing the waveform shape as compared to theoretical calculations. These results will be used to validate analytical models which form the basis of wind vector retrieval algorithms. These algorithms are already being validated from aircraft altitudes, but may be applied to data from future spaceborne GPS receivers. Surface wind data from radiosondes were used for comparison. This experiment was a cooperative project between NASA, the IEEC in Barcelona, and the University of Colorado at Boulder.

Author

Bistatic Reflectivity; Backscattering; Global Positioning System; Radar Scattering; Tracking Radar

~~200000~~92082 NASA Goddard Space Flight Center, Greenbelt, MD USA

A LEO Satellite Navigation Algorithm Based on GPS and Magnetometer Data

Deutschmann, Julie, NASA Goddard Space Flight Center, USA; Bar-Itzhack, Itzhack, Technion - Israel Inst. of Tech., Israel; Harman, Rick, NASA Goddard Space Flight Center, USA; [2000]; 9p; In English; Spaceflight Dynamics, June 2000, Biarritz, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Global Positioning System (GPS) has become a standard method for low cost onboard satellite orbit determination. The use of a GPS receiver as an attitude and rate sensor has also been developed in the recent past. Additionally, focus has been given to attitude and orbit estimation using the magnetometer, a low cost, reliable sensor. Combining measurements from both GPS and a magnetometer can provide a robust navigation system that takes advantage of the estimation qualities of both measurements. Ultimately a low cost, accurate navigation system can result, potentially eliminating the need for more costly sensors, including gyroscopes.

Author

Low Earth Orbits; Navigation; Algorithms; Global Positioning System; Magnetometers; Data Systems; Data Acquisition

~~200000~~92083 NASA Goddard Space Flight Center, Greenbelt, MD USA

Autonomous Navigation Improvements for High-Earth Orbiters Using GPS

Long, Anne, Computer Sciences Corp., USA; Kelbel, David, Computer Sciences Corp., USA; Lee, Taesul, Computer Sciences Corp., USA; Garrison, James, NASA Goddard Space Flight Center, USA; Carpenter, J. Russell, NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; 15th; Spaceflight Dynamics, Jun. 2000, Biarritz, France
Contract(s)/Grant(s): GS-35F-4381G; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Goddard Space Flight Center is currently developing autonomous navigation systems for satellites in high-Earth orbits where acquisition of the GPS signals is severely limited. This paper discusses autonomous navigation improvements for high-Earth orbiters and assesses projected navigation performance for these satellites using Global Positioning System (GPS) Standard Positioning Service (SPS) measurements. Navigation performance is evaluated as a function of signal acquisition threshold, measurement errors, and dynamic modeling errors using realistic GPS signal strength and user antenna models. These analyses indicate that an autonomous navigation position accuracy of better than 30 meters root-mean-square (RMS) can be achieved for high-Earth orbiting satellites using a GPS receiver with a very stable oscillator. This accuracy improves to better than 15 meters RMS if the GPS receiver's signal acquisition threshold can be reduced by 5 dB-Hertz to track weaker signals.

Author

Autonomous Navigation; Satellite Navigation Systems; Improvement; Earth Orbits; Geosynchronous Orbits; Global Positioning System; Navigation Satellites

~~200000~~92085 NASA Goddard Space Flight Center, Greenbelt, MD USA

Preliminary Operational Results of the TDRSS Onboard Navigation System (TONS) for the Terra Mission

Gramling, Cheryl, NASA Goddard Space Flight Center, USA; Lorah, John, Computer Sciences Corp., USA; Santoro, Ernest, Computer Sciences Corp., USA; Work, Kevin, Lockheed Martin Corp., USA; Chambers, Robert, Lockheed Martin Corp., USA; [2000]; 10p; In English; 15th; Spaceflight Dynamics, 26-30 Jun. 2000, Biarritz, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Earth Observing System Terra spacecraft was launched on December 18, 1999, to provide data for the characterization of the terrestrial and oceanic surfaces, clouds, radiation, aerosols, and radiative balance. The Tracking and Data Relay Satellite System (TDRSS) Onboard Navigation System (ONS) (TONS) flying on Terra provides the spacecraft with an operational real-time navigation solution. TONS is a passive system that makes judicious use of Terra's communication and computer subsystems. An objective of the ONS developed by NASA's Goddard Space Flight Center (GSFC) Guidance, Navigation and Control Center is to provide autonomous navigation with minimal power, weight, and volume impact on the user spacecraft. TONS relies on extracting tracking measurements onboard from a TDRSS forward-link communication signal and processing these measurements in an onboard extended Kalman filter to estimate Terra's current state. Terra is the first NASA low Earth

orbiting mission to fly autonomous navigation which produces accurate results. The science orbital accuracy requirements for Terra are 150 meters (m) (3sigma) per axis with a goal of 5m (1 sigma) RSS which TONS is expected to meet. The TONS solutions are telemetered in real-time to the mission scientists along with their science data for immediate processing. Once set in the operational mode, TONS eliminates the need for ground orbit determination and allows for a smooth flow from the spacecraft telemetry to planning products for the mission team. This paper will present the preliminary results of the operational TONS solution available from Terra.

Author

Earth Observing System (EOS); Terra Spacecraft; TDR Satellites; Onboard Equipment; Navigation Instruments; Autonomous Navigation

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

20000080346 Civil Aeromedical Inst., Oklahoma City, OK USA

Multidimensional Scaling Analysis of Controllers' Perceptions of Aircraft Performance Characteristics *Final Report*

Pfleiderer, Elaine M., Civil Aeromedical Inst., USA; July 2000; 38p; In English

Contract(s)/Grant(s): AAM-A-HRR-516

Report No.(s): DOT/FAA/AM-00/24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thirty full performance level (FPL) en route air traffic control specialists participated in an investigation of the salient features of aircraft mix, a proposed sector complexity factor. Controllers rated the "familiarity" (i.e., frequency of encounter) of 30 selected aircraft. They also provided weight class, engine number, engine type, cruising speed, climb, and descent rate estimates for each aircraft. A matrix of squared Euclidean distances derived from summary estimates (i.e., means of speed, climb, and descent) was used to construct a multidimensional scaling model of the aircraft. Multiple regression interpretation revealed that Dimension 1 was related to engine type, whereas Dimension 2 was associated with weight class. The position of elements in the derived stimulus space indicated that controllers may develop performance related prototypes through the use of multiple cues derived from a number of sources. Results are presented as justification for further investigation into potential advantages of providing enhanced prediction cues (e.g., engine type and weight class) from a single source, which may increase the efficiency of controller decision making and decrease perceived workload.

Author

Air Traffic Controllers (Personnel); Aircraft Performance; Perception; Scaling Laws; Flight Characteristics

20000080438 Defence Science and Technology Organisation, Melbourne Australia

A Sensor for Water Detection in Aircraft Adhesive Bondlines

Truong, V. T., Defence Science and Technology Organisation, Australia; Olsson-Jacques, C. L., Defence Science and Technology Organisation, Australia; Russo, M. S., Defence Science and Technology Organisation, Australia; Muscat, R. F., Defence Science and Technology Organisation, Australia; May 2000; 32p; In English

Report No.(s): AD-A378422; DSTO-RR-0172; DODA-AR-011-431; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A simple and low cost sensor for detecting the water ingress in the adhesive bond line was designed. A compressed polypyrrole (PPy) powder was embedded in an epoxy adhesive sandwiched between two aluminium (2024) substrates. Interactions between PPy and water resulted in a rapid increase in resistivity. The DC resistivity increased more than 20 times the initial value when the PPy was contacted by water. The increase was consistent with AC impedance at low frequencies which showed 10 times increase if one PPy disc (3 mm diameter) was embedded or 100 times increase if there were 3 PPy disc embedded when the cell was immersed in a brine solution for approximately 1000 h. The resistivity of compressed PPy embedded in the bondline was unchanged after 2000 h ageing at 100 C. This indicates a good thermal stability. An initial test indicated that the inclusion of a single 5mm diameter PPy disc in a 25mm diameter bonded joint did not significantly decrease the dry adhesive strength of the adhesive joint. These results indicate that the sensor could potentially meet the requirements of a bond degradation sensor in terms of: (1) low cost (few cents for one PPy disc); (2) sensitivity to water; (3) long-term stability; (4) ease of monitoring; and (5) sustaining the dry bond strength.

DTIC

Adhesive Bonding; Bonded Joints; Degradation; Detection; Airframes; Aircraft Equipment; Epoxy Compounds; Detectors

20000080477 Cranfield Univ., Flight Test and Dynamics Group, Bedford, UK
An Assessment of Supersonic Transport Aircraft Flying Quality Requirements
Steer, A. J., Cranfield Univ., UK; May 2000; 60p; In English
Report No.(s): COA-0003; ISBN 1-86194-050-5; Copyright; Avail: Issuing Activity

This report presents an assessment of supersonic transport aircraft flying quality requirements. The topics include: 1) Flying and Handling Qualities; 2) Airworthiness Requirements and Regulations; 3) Literature Review; 4) Applicable Handling Qualities Criteria; and 5) Alternative Command Types.

CASI

Aircraft Performance; Flight Characteristics; Supersonic Transports; Dynamic Response; Augmentation

20000081906 Maryland Univ., Dept. of Aerospace Engineering, College Park, MD USA
Smart Structures Technology: Innovations and Applications to Rotorcraft Systems *Final Report, 1 Jan. 1992-31 Dec. 1997*
Chopra, Inderjit, Maryland Univ., USA; May 2000; 93p; In English
Contract(s)/Grant(s): DAAL03-92-G-0121
Report No.(s): AD-A378791; ARO-30380.98-EG-URI; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The status of a number of rotorcraft research tasks supported under the Army Research Office "Smart Structures URI" program is reported herein for the reporting period from 1 January 1992 to 31 December 1997. For each task, the task objectives, the approach taken, and the final status of the research, and pertinent abstracts of journal articles or conference papers published as result of the research conducted under the task. Copies of all journal papers and conference papers that were produced under this program were forwarded to the U.S. Army Research Office in 1998, at the completion of the program, and are available upon request. The tasks are varied and cover many aspects of smart helicopter rotor development at the University of Maryland, including: (1) Development of a smart rotor using trailing edge flaps, and a controllable twist rotor blade, (2) Active tuning of composite shaft using shape memory alloy wires, (3) Active/passive damping for helicopter rotor stability augmentation, (4) Rotor acoustics control and analysis, (5) Health monitoring and damage detection, and (6) Elements of smart structures.

DTIC

Smart Structures; Shape Memory Alloys; Rotary Wings; Active Control

20000082024 Naval Postgraduate School, Monterey, CA USA
A Case History of the USA Army RAH-66 Comanche Helicopter
Galindo, Jason L.; Mar. 2000; 137p; In English
Report No.(s): AD-A378729; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The RAH-66 Comanche Helicopter was initiated as the Light Helicopter Family (LHX) in 1982 when an Army Aviation Mission Area Analysis (AAMAA) identified the need for an armed reconnaissance aircraft. Eighteen years later, the program has yet to reach a Defense Acquisition Board Milestone II review. This thesis described the history of the RAH-66 Comanche Helicopter acquisition program during these years. The research focused on the question of what significant events and issues have occurred over the course of the Comanche's development that have allowed it to remain a viable program. The research draws several conclusions from the analysis of the Comanche's history. Mainly, despite the significant duration of the program, a valid need for an armed reconnaissance platform still exists. Secondly, the innovative program management of Comanche has maintained a positive reputation for the program. Finally, the loss of Comanche at this point in time would severely impact the defense helicopter industrial base.

DTIC

Light Helicopters; Reconnaissance Aircraft; Case Histories

20000083048 Ohio State Univ., Dept. of Mechanical Engineering, Columbus, OH USA
Planetary Gear Dynamics in Military Helicopters *Final Report, 14 Aug. 1998-14 Feb. 2000*
Parker, Robert G., Ohio State Univ., USA; May 10, 2000; 9p; In English
Contract(s)/Grant(s): DAAG55-98-1-0389

Report No.(s): AD-A378777; ARO-37382.4-EG-YIP; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This research is a comprehensive analytical and computational investigation of the dynamic response of planetary gears. In military helicopters, planetary gears are typically the last stage gear reduction whose output drives the main rotor. Their dynamics dominate the cabin noise. Furthermore, the frequency of the noise is in the range most audible by humans. With deeper understanding of planetary gear dynamics, the goals are to reduce the noise, vibration, and weight of helicopter planetary gears while simultaneously increasing their reliability. This project will also develop lumped-parameter and finite element analysis tools for planetary gears. These tools are notably lacking despite the importance of planetary gears in helicopters, cars, heavy

machinery, marine vehicle and other applications. Planetary gears have received little prior research attention as most gear dynamics studies address the simpler case of a single pair of meshing gears. Thus, the potential for scientific advancement and near-term practical application of the results is excellent. The unique computational tool available for this effort makes the objectives particularly achievable.

DTIC

Astrodynamics; Structural Vibration; Vibration Tests; Aircraft Noise; Noise Reduction

20000083052 Department of Defense, Office of the Inspector General, Arlington, VA USA

Procurement of the Propeller Blade Heaters for the C-130 and P-3 Aircraft

Jun. 12, 2000; 40p; In English

Report No.(s): AD-A378804; IG/DOD-D-2000-099; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is one in a series involving the pricing of commercial and noncommercial spare parts. During a previous audit, we identified prices for C-130 aircraft propeller blade heaters as a topic warranting further review. The virtual prime vendor contract was issued to United Technologies Corporation, Hamilton Standard Division. This report addresses pricing problems with the C-130 and P-3 blade heaters. In 1998, DoD paid \$1.4 million for C-130 and P-3 blade heaters. Both blade heaters are manufactured by BF Goodrich and are procured on the Hamilton Standard virtual prime vendor contract through Derco Aerospace, subcontractor to Hamilton Standard. The Defense Supply Center Richmond awarded and used the virtual prime vendor contract to procure the C-130 blade heaters. The Defense Industrial Supply Center started using the virtual prime vendor contract to procure the P-3 blade heaters in 1999. Prior to the virtual prime vendor contract, the P-3 blade heaters were procured directly from BF Goodrich. In June 1999, United Technologies Corporation acquired Sundstrand Corporation and merged its Hamilton Standard division creating a new company, Hamilton Sundstrand.

DTIC

Aircraft Equipment; C-130 Aircraft; Procurement; Propeller Blades; P-3 Aircraft; Heating Equipment

20000083066 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Advancement of Bi-Level Integrated System Synthesis (BLISS)

Sobieszczanski-Sobieski, Jaroslaw; Emiley, Mark S.; Agte, Jeremy S.; Sandusky, Robert R., Jr; Jun. 15, 2000; 10p; In English

Report No.(s): AD-A378905; AFIT-FY00-209; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Bi-Level Integrated System Synthesis (BLISS) is a method for optimization of an engineering system, e.g., an aerospace vehicle. BLISS consists of optimizations at the subsystem (module) and system levels to divide the overall large optimization task into sets of smaller ones that can be executed concurrently. In the initial version of BLISS that was introduced and documented in previous publications, analysis in the modules was kept at the early conceptual design level. This paper reports on the next step in the BLISS development in which the fidelity of the aerodynamic drag and structural stress and displacement analyses were upgraded while the method's satisfactory convergence rate was retained.

DTIC

Aerospace Vehicles; Aircraft Design; Computerized Simulation; Systems Engineering

20000083972 Naval Postgraduate School, Monterey, CA USA

UH-60 Black Hawk Disturbance Rejection Study for Hover/Low Speed Handling Qualities Criteria and Turbulence Modeling

Labows, Steven J.; Mar. 2000; 123p; In English

Report No.(s): AD-A378452; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Helicopters operate in an environment where task performance can easily be affected by atmospheric turbulence. This paper discusses the airborne flight test of the Sikorsky UH-60 Black Hawk helicopter in turbulent conditions to determine disturbance rejection criteria and to develop a low speed turbulence model for helicopter simulation. A simple approach to modeling the aircraft response to turbulence is described by using an identified model of the Black Hawk to extract representative control inputs that replicate the aircraft response to disturbances. This parametric turbulence model is designed to be scaled for varying levels of turbulence and utilized in ground or in-flight simulation. Flight control cutoff frequency data are also analyzed to support design criteria for gust rejection handling qualities.

DTIC

UH-60A Helicopter; Aircraft Design; Flight Control; Aircraft Performance; Atmospheric Turbulence; Design Analysis; Turbulence Models

20000083973 Naval Postgraduate School, Monterey, CA USA

Quality Functional Deployment as a Conceptual Aircraft Design Tool

Tan, Rendell K.; Mar. 2000; 102p; In English

Report No.(s): AD-A378471; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Quality Functional Deployment (QFD) methodology was applied as a possible system integration tool for use during the conceptual configuration design phase of low speed High Altitude Long Endurance (HALE) UAVs. A four-level QFD model was used to identify important design variables and prioritize those that impact customer attributes. The customer attributes were deployed into performance parameters. The performance parameters were deployed into UAV part characteristics. The part characteristics were deployed into manufacturing processes. The manufacturing processes were deployed into process controls. Based on QFD, the research effort showed that to achieve the customer attributes of high endurance, range, cruise altitude and payload, the important performance parameters are low gross weight, low $C(D,0)$, high $C(L,max)$ and a low life cycle cost. The part characteristics considered for the conceptual HALE UAV configuration were maximum utilization of composites, thick airfoil (to increase fuel capacity), high wing fatigue strength and low wing sweep. to achieve the part characteristics, the manufacturing methods considered were autoclaving and filament winding for composites components; milling and precision forging were considered for aluminum alloy components. Manufacturing process controls were also identified. In each QFD matrix, the technical correlations roof provided an effective mechanism for comparing each design parameter against other design parameters in order to determine conflicting design requirements.

DTIC

Aircraft Design; Computer Aided Design; Reconnaissance Aircraft; Software Development Tools; Pilotless Aircraft; Design Analysis; Quality Control

20000085873 NASA Langley Research Center, Hampton, VA USA

Low Order Equivalent System for the TU-144LL Supersonic Transport Aircraft

Morelli, Eugene A., American Inst. of Aeronautics and Astronautics, USA; [2000]; 16p; In English; Atmospheric Flight Mechanics Conference, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 2000-3902; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Low order equivalent system models were identified from flight test data for the TU- 144LL supersonic transport aircraft. Flight test maneuvers were executed by Russian and American test pilots flying the aircraft from Zhukovsky airfield outside Moscow, Russia. Flight tests included longitudinal and lateral/directional maneuvers at supersonic cruise flight conditions. Piloted frequency sweeps and multi-step maneuvers were used to Generate data for p closed loop low order equivalent system modeling Model parameters were estimated using a flexible, high accuracy Fourier transform and an equation error output error (EE/OE) formulation in the frequency domain. Results were compared to parameter estimates obtained using spectral estimation and subsequent least squares fit to frequency response data in Bode plots. Modeling results from the two methods a-reed well for both a frequency sweep and multiple concatenated multi-step maneuvers. For a single multi-step maneuver, the EE/OE method gave a better model fit with improved prediction capability. A summary of closed loop low order equivalent system identification results for the TU-144LL. including estimated parameters, standard errors, and flying qualities level predictions, were computed and tabulated.

Author

Supersonic Transports; Flight Tests; Frequency Response; Least Squares Method; Flight Conditions; Flight Characteristics

20000085892 Pioneer Aerospace Corp., South Windsor, CT USA

Development of the NASA X-38 Parafoil Landing System

Fox, Roy, Aerospace Recovery Systems, USA; Smith, John, Pioneer Aerospace Corp., USA; Bennett, Thomas, Pioneer Aerospace Corp., USA; 1999; 13p; In English; 15th; 15th Aerodynamic Decelerator Systems Technology Conference and Seminar, 81-11 Jun. 1999, Toulouse, France; Sponsored by National Oceanic and Atmospheric Administration, USA Report No.(s): AIAA Paper 99-1730; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA X-38 flight vehicle is being designed to provide a method for returning personnel to Earth from the International Space Station. This Crew Return Vehicle(CRV) will reenter the atmosphere and use a staged parachute system for stabilization, deceleration, and final descent. The Parafoil Landing System(PLS) consists of a mortar deployed pilot parachute, a drogue decelerator, and a parafoil which includes a GPS based Navigation, Guidance, and Control System to command maneuvers and a flared landing. Complete PLS component descriptions are provided in this paper. Techniques to improve parafoil initial inflation and opening dynamics are discussed. This includes the use of trailing edge ties, aspect ratio variation, and rigging angle selection. Techniques that have been evaluated to reduce canopy rebound are also presented. This includes a method for parachute drag area reduction and the use of a long stroke ripstitch energy modulator. The PLS has been used to recover 15,000 lb X-38 vehicle

prototypes. A parafoil of approximately 7,500 sq ft is being planned for use with the 22,200 lb Vehicle 201 CRV advanced prototype. Development of the PLS and back-up system is continuing towards space environment qualification and man-rating verification tests.

Author

X-38 Crew Return Vehicle; Parafoils; Aerospace Environments; Global Positioning System; Guidance (Motion)

20000085907 Cranfield Univ., College of Aeronautics, Bedford, UK

Aircraft Parameter Identification Using Matlab

Mullen, G. J., Cranfield Univ., UK; June 2000; 90p; In English

Report No.(s): COA-Rept-0011; ISBN 1-86194-052-1; Copyright; Avail: Issuing Activity

System identification techniques are routinely used in experimental stability and control studies throughout the aerospace industry. Over the years, various researchers at the College of Aeronautics have contributed to this field; most recently some of the latest methods have been employed to estimate the stability and control derivatives of a variety of aircraft types. Although the more recent investigations provide a useful insight into the capabilities and characteristics of several up-to-date methods, they have not resulted in tools which may be used on a routine basis. Consequently, the purpose of this report is to describe a set of procedures which are straightforward to apply, and produce reasonable solutions to the type of linear parameter identification problems which are often found in aerospace work. Recordings of the short period and phugoid modes from Handley-Page Jetstream G-NFLC are used throughout as examples. Firstly, those characteristics of the aircraft's instrumentation system which influence the quality of the signals sample rate, anti-aliasing filters, time delays are considered. This information is used in conjunction with standard signal processing techniques to ensure that the data is of sufficient quality to be used in the parameter estimation process. Next, a basic Fourier analysis and a least squares algorithm are employed to produce nonparametric and parametric models respectively. The results thus obtained are comparable to those generated using more sophisticated techniques. In conclusion, standard signal processing methods combined with relatively simple estimation theory offer an adequate solution to the linear parameter estimation problem.

Author

Estimating; Fourier Analysis; Parameter Identification; Signal Processing; System Identification; Aerospace Industry

20000088514 Colorado Univ., Dept. of Civil Environmental and Architectural Engineering, Boulder, CO USA

Modeling the Fate of Military Aircraft Anti-Deicing Agents Through Environmental Transport Final Report, 1 Mar. 1997-31 Aug. 1999

Znidarcic, Dobroslav; Jun. 2000; 39p; In English

Contract(s)/Grant(s): F49620-97-1-0176; AF Proj. 6624

Report No.(s): AD-A379394; AFRL-SR-BL-TR-00-0274; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

All potential deicing locations including: Pad 23, Pad 05, Pad 19, North Ramp, VIP, East Ramp at E-8, and the fuel cell for tail deicing are identified. Deicing is generally done at Pads 23 and 05. Pad 19 was a one time occurrence due to a Special Operation that overwhelmed the parking capacity and is unlikely to ever be used again for deicing. If deicing occurs at the East Ramp, the North Ramp, the VIP or the fuel cell, the storm drains are covered with mats and the ADF waste is collected with sweeper trucks and deposited in an 8000 gallon dedicated collection tank in the pull-through hangar.

DTIC

Military Aircraft; Waste Disposal; Deicing; Aircraft Icing

20000088516 Naval Postgraduate School, Monterey, CA USA

A Cost Benefit Analysis of the Depot Modification Field Teams for the T-45C Aircraft

Parish, James M.; Jun. 2000; 78p; In English

Report No.(s): AD-A379417; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This thesis focuses on the current procedures for implementing the Depot modifications on the T-45 training aircraft located at NAS Meridian, Ms. used by the Navy to train its Student Naval Aviators. Using cost-benefit analysis, it analyzes the feasibility of performing the modifications at the existing Contractor Depot Field Team site at NAS Kingsville, TX or standing up an additional mod line at NAS Meridian, Ms. The analysis demonstrates the savings for the Navy available by expanding the existing mod line at NAS Kingsville, TX with out sacrificing any readiness or lost training days.

DTIC

Aircraft Maintenance; Cost Analysis; Training Aircraft

20000088658 Naval Postgraduate School, Monterey, CA USA

A Cost Analysis of the Decision to Cannibalize Major Components of the Navy's H-60 Helicopters at the Operational Level

Kowalski, Danny E.; Jun. 2000; 88p; In English

Report No.(s): AD-A379704; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Cannibalization is a technique, sanctioned by the Navy, for maintenance managers to optimize aircraft availability by circumventing a slow or inadequate logistics support system. Maintenance managers often make a decision to cannibalize without considering the total cost of their decision. This thesis examines the costs incurred by an operational H-60 helicopter squadron to cannibalize major components and addresses the impact of cannibalization on the mean time between failure for the cannibalized components. The costs to cannibalize a T700-GE-401C engine, a tail rotor blade and an auxiliary power electronic control unit were calculated by assigning a dollar value to the increased manpower, consumables and flight time that could have been avoided if cannibalization were not used. The units cannibalized in 1996 were tracked by serial number through 1999 to compare their mean time between failure to similar non-cannibalized units for the same period. The findings were that cannibalization considerably decreases the time between failure for cannibalized components which can have reaching effects on the size and costs of the Navy's inventory of spare parts. The increased manpower, consumables and flight time required has a significant impact on an operational squadron's workforce and budget.

DTIC

Cost Analysis; H-60 Helicopter; Navy; Aircraft Maintenance

20000088681 Fairchild Aircraft, San Antonio, TX USA

Development of Supplemental Inspection Report for the Fairchild Metro SA226 and SA227 Airplane *Final Report*

Dwyer, W.; Apr. 2000; 82p; In English

Contract(s)/Grant(s): DTFA03-96-C-00044

Report No.(s): AD-A379501; DOT/FAA/AR-00/18; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This document is the final report covering the results of a 3-year program entitled "Development of a Supplemental Inspection Document for "A226/SA227 Aircraft." The program focused on developing a supplemental inspection document (SID) for all variants of the SA226 and SA227 based on damage tolerance analysis techniques. The SA226 and SA227 were designed and certified prior to the advent of modern damage tolerance analysis or FAR amendments, which require the aircraft structure to meet damage tolerance requirements. A major portion of this study consisted of collecting the data and performing the analysis necessary to establish an inspection program based on current damage tolerance methodology. Material and component tests, service experience, strain surveys, stress analysis, and fracture mechanics tools were all utilized to establish this program, which provides inspections and modifications necessary to help ensure the continued structural integrity of the airplane. These items were accomplished and the SID was developed.

DTIC

Aircraft Structures; Tolerances (Mechanics); Inspection

20000089841 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA

Distributed Test and Evaluation of Aerospace Systems: The Joint Advanced Distributed Simulation Joint Test Force Experience

Smith, Mark E.; Aug. 1999; 13p; In English

Report No.(s): AD-A378017; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation Joint Test Force (JADS JTF) is chartered by the U.S. Office of the Secretary of Defense (OSD) to determine the utility of advanced distributed simulation (ADS) for both developmental and operational test and evaluation (DT&E and OT&E). The program is nearing its completion and this paper is designed to provide a report on the utility of ADS in enabling the distributed test and evaluation (T&E) of aerospace systems. The paper opens with a brief overview of ADS technology and distributed T&E then provides a short description of the JADS Joint Test and Evaluation (JT&E) program. The main portion of the paper will discuss results, lessons learned and conclusions derived by the JADS JTF. As this paper uses material directly from JADS reports prepared by many members of the JADS JTF, the credit for this paper goes to them. Readers are encouraged to seek more information on the JADS web site (<http://www.jads.abq.com>) which will be active until March 2001.

DTIC

Evaluation; Performance Tests; Computerized Simulation; Aerospace Systems

20000089955 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory: An Aerodynamic Design Method for Generating Low Sonic-Boom Pressure Signatures

Makino, Y.; Aoyama, T.; Iwamiya, T.; Watanuki, T.; Kubota, H.; Feb. 2000; 28p; In Japanese

Report No.(s): PB2000-106822; NAL/TR-1406; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

A study was conducted of an aerodynamic design for the sonic-boom reduction of supersonic transport. Sonic-boom is one of the most important environmental problems for supersonic transport and many methods for the reduction of sonic-boom intensity have been published. A new low sonic-boom design method is proposed in this study in order to deal with the nonlinear effects of the strong shocks near the aircraft and the three-dimensional effects of the aircraft configuration unable to be taken into account in the F-function method. This new low sonic-boom design method combines a three-dimensional Euler CFD code with a least-square optimization technique.

NTIS

Aerodynamics; Supersonic Flight; Noise Reduction; Design Analysis; Sonic Booms; Low Pressure

20000090530 Naval Postgraduate School, Monterey, CA USA

UH-60 Black Hawk Disturbance Rejection Study for Hover/Low Speed Handling Qualities Criteria and Turbulence Modeling

Labows, Steven J., Naval Postgraduate School, USA; Blanken, Chris L., Army Aviation and Missile Command, USA; Tischler, Mark B., Army Aviation and Missile Command, USA; [1999]; 6p; In English; 56th, Unknown; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): RTOP 581-30-22; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper will discuss the airborne flight test of the Sikorsky UH-60 Black Hawk helicopter in turbulent conditions to determine disturbance rejection criteria and develop a low speed wind/turbulence model for helicopter simulation.

Author

Helicopters; Flight Tests; Flight Conditions; Turbulence

20000092065 NASA Ames Research Center, Moffett Field, CA USA

Experimental Analysis of Steady-State Maneuvering Effects on Transmission Vibration Patterns Recorded in an AH-1 Cobra Helicopter

Huff, Edward M., NASA Ames Research Center, USA; Dzwonczyk, Mark, California Signal Processing Associates, Inc., USA; [2000]; 5p; In English; American Helicopter Society Annual Forum, 2-5 May 2000, Virginia Beach, VA, USA; Sponsored by American Helicopter Society, Inc., USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Flight experiment was designed primarily to determine the extent to which steady-state maneuvers influence characteristic vibration patterns measured at the input pinion and output annulus gear locations of the main transmission. If results were to indicate that maneuvers systematically influence vibration patterns, more extensive studies would be planned to explore the response surface. It was also designed to collect baseline data for comparison with experimental data to be recorded at a later date from test stands at Glenn Research Center. Finally, because this was the first vibration flight study on the Cobra aircraft, considerable energy was invested in developing an in-flight recording apparatus, as well as exploring acceleration mounting methods, and generally learning about the overall vibratory characteristics of the aircraft itself.

Derived from text

Steady State; Transmissions (Machine Elements); Gears; Vibration; Structural Analysis

20000092066 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA

A Comparison of Active Sidestick and Conventional Inceptors for Helicopter Flight Envelope Tactile Cueing

Whalley, Matthew S., Army Aviation and Missile Command, USA; Hindson, William, Army Aviation and Missile Command, USA; Thiers, George, Princeton Univ., USA; [2000]; 7p; In English, 2-4 May 2000, Virginia Beach, VA, USA; Sponsored by American Helicopter Society, Inc., USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper will compare the results of two ground-based piloted simulation studies of helicopter flight envelope tactile cueing. The objective of these trials was to develop methods of assisting the pilot in respecting flight envelope limits in a high workload environment. Both trials looked at the same aggressive hover and forward-flight tasks, the difference being that in the first trial, large-displacement programmable force-feel inceptors were used while in the second programmable short active sidesticks were used.

Author

Helicopters; Flight Envelopes; Flight Tests; Horizontal Flight; Tasks; Hovering; Queueing Theory

20000092492 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Stress Analysis of the F-111 Wing Pivot Fitting

Weller, S., Defence Science and Technology Organisation, Australia; McDonald, M., Defence Science and Technology Organisation, Australia; Apr. 2000; 28p; In English

Report No.(s): AD-A379870; DSTO-TN-0271; DODA-AR-011-422; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A number of high stress and potential cracking sites in the F-111 wing pivot fitting (WPF) have been identified using a validated 3D finite element model. Selected locations have been analyzed in detail, and ranked according to the magnitude of the peak stress. These locations have also been compared with known sites of in-service cracking. Overall, there is very good agreement between the locations identified from the finite element model and those experiencing in-service cracking. The results from this investigation may assist the RAAF in reviewing inspection requirements for the F-111 WPF.

DTIC

F-111 Aircraft; Finite Element Method; Fitting; Pivots; Stress Analysis; Variable Sweep Wings

20000093320 Defence Science and Technology Organisation, Joint Systems Branch, Salisbury, Australia

Background for Joint System Aspects of AIR 6000

Staker, Rod, Defence Science and Technology Organisation, Australia; Moon, Terry, Defence Science and Technology Organisation, Australia; April 2000; 36p; In English

Report No.(s): DSTO-CR-0155; AR-011-465; Copyright; Avail: Issuing Activity

This document provides background information that will be used as a basis for studies undertaken as part of the Joint Systems Aspects of AIR 6000 task. It discusses some of the issues surrounding the AIR 6000 project and describes the context for future Joint Systems Branch studies in support of the project.

Author

Personnel; Military Operations; Tactics; Aircraft Equipment

20000093799 Naval Research Lab., Bay Saint Louis, MS USA

AV-8B Map System II: Moving Map Composer (MMC) Version 3.3, Software Users' Manual, Second Edition

Lohrenz, Maura C.; Gendron, Marlin L.; Myrick, Stephanie A.; Mehaffey, J. M.; Trenchard, Michael E.; Jun. 30, 2000; 83p; In English

Report No.(s): AD-A380418; NRL/FR/7740--00-9938; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 7440.1. This is the second edition of the MMC Users' Manual (the first edition is NRL/FR/7441--97-9677) and reflects changes that were implemented for the latest release (version 3.3) of MMC. The MMC software is resident on the Map-II Station portion of the AV-8B Mission Support System, which NRL designed and configured in support of AV-8B mission planners and pilots in the field. MMC enables users to perform the following functions: design and build Aircraft Optical Disk (AOD) images from user-specified Compressed Aeronautical Chart (CAC) and scanned chart data; include emergency checklists and reconnaissance photographs in an AOD image; write completed AOD images to militarized Write-Once Read-Many AODs; evaluate failed AODs and recover from failed AOD image builds; design and build Mission Planning System Compact Disk Images (MPS-CDIs) from user-specified CAC, scanned chart, and DTED data; write MPS-CDIs to Recordable Compact Disk (CD-R) for mission planning purposes; scan and compress paper charts into a CAC-compatible format (when CAC or Arc Digitized Raster Graphics (ADRG) are not available) and include them in an AOD image or MPS-CDI; print final compositions, CAC images, checklists, and AOD summaries (new function in MMC version 3.3). The AV-8B Map-II Stations have completely replaced all map data functions and all optical disk image functions that previously were handled by the AV-8B Map, Operator, and Maintenance Stations (MOMS). to date, the AV-8B program has purchased eight NRL-developed Map-II Stations (including two for the Spanish AV-8B and one for the Italian AV-8B), and the F/A-18 program has purchased two.

DTIC

User Manuals (Computer Programs); Software Development Tools

20000094284 Air Force Inst. of Tech., Advanced Engineering Management Group, Wright-Patterson AFB, OH USA

Dynamic Route Replanning and Retasking of Unmanned Aerial Reconnaissance Vehicles

Pritchard, David E.; Mar. 2000; 87p; In English

Report No.(s): AD-A380239; AFIT/GAE/ENY/00M-10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Many common operational situations in High Altitude Endurance (HAE) UAV reconnaissance necessitate more direct human involvement in the aircraft control process than is currently acknowledged or allowed. The In-Flight Replanning System (IFRS)

is developed as a notional solution, with the Global Hawk HAE UAV as the reconnaissance system model. Problematic scenarios for current in-flight mission replanning systems are presented and revisited with the IFRS, demonstrating improved replanning results.

DTIC

Aerial Reconnaissance; Pilotless Aircraft; Flight Plans; Reconnaissance Aircraft

20000094328 Webb Research Corp., East Falmouth, MA USA

An Autonomous Gliding Vehicle for the Distributed Observation of the Littoral Environment, 26 May 1998 - 26 May 2000

Webb, Douglas C.; Jul. 2000; 16p; In English

Contract(s)/Grant(s): N00014-98-C-0281

Report No.(s): AD-A380432; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An AUV glider (AUVG), optimize for long range and endurance littoral operations, has been designed, constructed, and operated for an extended period in an adaptive sampling mode as a component of a larger littoral scientific program. The AUVG, called SLOCUM, is comparatively simple, easy to operate with a small team and inexpensive to reproduce. The principal operational specifications are: - Displacement 50 kg - Navigation reference GPS - Range 1800 km - Payload general purpose platform, - Endurance 60 days currently Seabird CTP - Speed, horizontal 0.35 m/s - Maximum operating depth. 200m - Communication: RF LAN and ARCOS - Batteries - alkaline Control design approach has been the transfer from the MIT AUV laboratory of both. their concept of control architecture, and of the use of the specific software used in the Odyssey AUV with appropriate modification for AUVGs.

DTIC

Gliding; Gliders

20000094350 Virginia Polytechnic Inst. and State Univ., Interdisciplinary Center for Applied Mathematics, Blacksburg, VA USA

A Computational Environment for Design of Aerospace Systems Final Report, 1 Mar. 1999-28 Feb. 2000

Burns, John A.; Apr. 28, 2000; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0121

Report No.(s): AD-A379978; ICAM00-04-04; AFRL-SR-BL-TR-00-0335; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains a summary and highlights of the work funded by the Air Force under AFOSR Grant F49620-99-1-0121, titled "A Computational Environment for Design of Aerospace Systems". This effort, funded under the Defense University Research Instrumentation Program (DURIP), was conducted by the Center for Optimal Design and Control (CODAC), at Virginia Tech during the period 1 March 1999-28 February 2000. The objective of the grant was to enhance the computational facilities we have assembled for a sensitivity-based design environment. In recent years researchers at CODAC have developed mathematical foundations and a computational framework for the rapid calculation of design- sensitivities for aerospace applications. Implementation requires approximate solution of certain linear partial differential equation In aerodynamic applications, for example, these solutions describe in linear approximation how the flow will change with a given change in a (geometric) design parameter. We have acquired an SGI Origin 2000 computer with 32 processors and two SGI Octane workstations to provide the computational platform for these calculations.

DTIC

Mathematical Models; Optimization; Computational Fluid Dynamics; Design Analysis; Aerospace Engineering; Linear Equations; Approximation; Differential Equations

20000094378 Dayton Univ. Research Inst., Structural Integrity Div., OH USA

Statistical Loads Data for BE-1900D Aircraft in Commuter Operations Final Report

Tipps, Daniel O., Dayton Univ. Research Inst., USA; Skinn, Donald A., Dayton Univ. Research Inst., USA; Rustenburg, John W., Dayton Univ. Research Inst., USA; Zeiler, T. A., Alabama Univ., USA; Apr. 2000; 78p; In English

Report No.(s): PB2000-105935; UDR-TR-1999-00061; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The primary objective of this research is to support the FAA Airborne Data Monitoring Systems Research Program by developing new and improved methods and criteria for processing and presenting commuter airplane flight and ground loads usage data. The scope of activities performed involves defining the service related factors that affect the operational life of commuter aircraft and providing processed data in statistical formats that will enable the FAA to reassess existing certification criteria. Equally important, these new data will enable the FAA, the aircraft manufacturers, and the airlines to better understand and control those factors that influence the structural integrity of commuter aircraft. The University of Dayton under contract with the University of Alabama processed digital flight recorder data collected from 903 flights representing approximately 585 flight

hours recorded on 28 typical BE-1900D aircraft during typical operational usage by a single commuter airline. This report presents statistical summaries of aircraft usage data, ground loads data, flight loads data, and systems operational data collected from these aircraft. Statistical data are presented for parameters such as gust and maneuver acceleration, airspeed, altitude, flight duration and distance, engine RPM and torque, time at propeller reversal, derived gust velocity, V-n diagrams, and vertical and longitudinal accelerations during ground operations. This report presents the results from this effort.

NTIS

Commuter Aircraft; Flight Load Recorders; Service Life; Flight Operations; Statistical Analysis; Data Processing; Aerodynamic Loads; Data Acquisition; Data Systems; Structural Reliability

06

AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

2000008667 NASA Johnson Space Center, Houston, TX USA

X-38 V201 Avionics Architecture

Bedos, Thierry, MATRA Marconi Space, France; Anderson, Brian L., NASA Johnson Space Center, USA; [1999]; 12p; In English; Atmospheric Reentry Vehicles and Systems, 16 Mar. 1999, Unknown

Contract(s)/Grant(s): RTOP 906-42-XC-RV; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The X-38 is an experimental NASA project developing a core human capable spacecraft at a fraction of the cost of any previous human rated vehicle. The first operational derivative developed from the X-38 program will be the International Space Station (ISS) Crew Return Vehicle (CRV). Although the current X-38 vehicles are designed as re-entry vehicles only, the option exists to modify the vehicle for uses as an upward vehicle launched from an expendable launch vehicle or from the X-33 operational derivative. The Operational CRV, that will be derived from the X-38 spaceflight vehicle, will provide an emergency return capability from the International Space Station (ISS). The spacecraft can hold a crew of up to seven inside a pressurized cabin. The CRV is passively delivered to ISS, stays up to three year on-orbit attached to ISS in a passive mode with periodic functional checkout, before separation from ISS, de-orbit, entry and landing. The X-38 Vehicle 201 (V201) is being developed at NASA/JSC to demonstrate key technologies associated with the development of the CRV design. The X-38 flight test will validate the low cost development concept by demonstrating the entire station departure, re-entry, guidance and landing portions of the CRV mission. All new technologies and subsystems proposed for CRV will be validated during either the on orbit checkout or flight phases of the X-38 space flight test. The X-38 subsystems are required to be similar to those subsystems required for the CRV to the greatest extent possible. In many cases, the subsystems are identical to those that will be utilized on the Operational CRV.

Derived from text

X-38 Crew Return Vehicle; Avionics; Aircraft Design; Aircraft Instruments

20000088683 Stanford Univ., Stanford, CA USA

Formal Specification and Simulation of Reference Architectures for Distributed and Safety Critical Avionics Systems Final Report, 1 Jan. 1995 - 31 Mar. 1998

Luckham, David C.; Mar. 31, 1998; 7p; In English

Contract(s)/Grant(s): F49620-95-1-0093

Report No.(s): AD-A379499; AFRL-SR-BL-TR-00-0223; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The original scope of this effort had two main objectives: (1) investigate fundamental implementation algorithms to extend the Rapide event-based architecture definition and simulation system by adding a capability for formal constraint-based specification of systems, and for checking conformance of systems to formal constraints, (2) demonstrate scalability of Rapide to simulate functional behavior and predict performance of different kinds of distributed systems, including avionics, simulation networks, training systems, secure information systems and command and control systems. In addition, new directions were added to include: (1) a technology transition effort, to enable rapide to be used for system architecture prototyping, and (2) development of event-based technology, called Complex event Processing, to enable instrumentation of systems to test their conformance to design constraints.

DTIC

Specifications; Architecture (Computers); Computerized Simulation

20000089726 National Aerospace Lab., Flight Systems Research Center, Tokyo, Japan

High-Tc Superconducting Accelerometer

Enkyo, Shigeharu, National Aerospace Lab., Japan; Nakajima, Atushi, National Aerospace Lab., Japan; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 527-530; In English; See also 20000089691; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

Ultra-high resolution accelerometer is required in completing the high precision airplane inertial navigation system employing a gravity gradiometer which compensates the geodetic induced error and is also required in micro-g environment in space. The resolution of the conventional accelerometer is limited in the order of 10^{-6} gE. On the contrary, superconducting accelerometer has the potential of 10^{-12} gE. In National Aerospace Laboratory (NAL), a principle model of a high-Tc superconducting accelerometer operated at the liquid nitrogen temperature (77K) was designed, manufactured and evaluated and some of the characteristics are described in this paper.

Author

Accelerometers; High Temperature Superconductors; High Resolution; Aerospace Systems; Manufacturing

20000089952 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory: Error Analysis of the DGPS/INS Hybrid Navigation System and Its Flight Evaluation

Harigae, M.; Tsujii, T.; Murata, M.; Ono, T.; Inagaki, T.; Jan. 2000; 60p; In Japanese

Report No.(s): PB2000-106819; NAL/TR-1398; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

In this paper the authors propose for navigation error analysis, which is indispensable for the practical application of the DGPS/INS hybrid navigation system in the aerospace field, and then conduct flight tests to evaluate the results of error analysis using this method.

NTIS

Aerospace Industry; Error Analysis; Flight Tests

20000089954 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory. Development of Precision Approach and Landing Navigation System Using the Carrier-Phase DGPS/INS Hybrid Navigation Algorithm

Harigae, M.; Tsujii, T.; Murata, M.; Ono, T.; Inagaki, T.; Jan. 2000; 28p; In Japanese

Report No.(s): PB2000-106821; NAL/TR-1399; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The FANS (Future Air Navigation System) committee, under the ICAO (International Civil Aviation Organization), is studying utilization of the global navigation satellite system and advising on the development of a GPS (Global Positioning System) precision approach and landing navigation system for improving flight safety around terminal areas. The principal problems in the creation of the system are as follows: Achieving sub-meter level accuracy; Providing 6-degree of freedom navigation information characterized by a wide dynamic range; and Creating a system with high availability and high continuity.

NTIS

Approach; Flight Safety; Air Navigation; Navigation Satellites; Landing Aids; Algorithms

20000092467 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory: An Integrated Three-Dimensional Terrain and Primary Flight Display for Terrain Awareness and Alerting

Brown, M. A.; Nov. 1999; 46p; In English; Original contains color illustrations

Report No.(s): PB2000-106815; NAL/TR-1391T; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This report describes preliminary research into three-dimensional (3D) terrain displays for enhancing pilot terrain situational awareness and warning of potential ground collision. Two-dimensional plan-view terrain displays, as employed by current advanced terrain avoidance warning systems, are reviewed and their characteristics discussed. Previous research into 2D and 3D terrain displays is then examined to elucidate the relative merits and demerits of each format. A prototypical 3D terrain display integrated with a primary flight display, dubbed the Primary Flight and Terrain Display (PFTD), was developed to evaluate the technical and operational feasibility of using computer-generated 3D terrain images to enhance pilot terrain situational awareness. Various technical aspects of the implementation are discussed. In particular the selection of visual cues to enable the form of the terrain to be perceived with sufficient depth and trade-offs with computational load. The results of preliminary qualitative evaluation by a test pilot are also presented. Finally, this report briefly examines potential technical and operational problems of

three-dimensional computer-generated terrain renderings for aerospace applications, including the problems of navigation and database error and human factor problems.

NTIS

Display Devices; Nap-Of-The-Earth Navigation; Terrain Analysis; Tercom; Aerospace Engineering; Warning Systems

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

20000081673 NASA Glenn Research Center, Cleveland, OH USA

Augmentation of Stagnation Region Heat Transfer Due to Turbulence From a DLN Can Combustor

VanFossen, G. James, NASA Glenn Research Center, USA; Bunker, Ronald S., General Electric Co., USA; July 2000; 14p; In English; 45th; International Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 523-26-13

Report No.(s): NASA/TM-2000-210241; E-12360; NAS 1.15:210241; ASME Paper 2000-GT-0215; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Heat transfer measurements have been made in the stagnation region of a flat plate with a circular leading edge. Electrically heated aluminum strips placed symmetrically about the leading edge stagnation region were used to measure spanwise averaged heat transfer coefficients. The maximum Reynolds number obtained, based on leading edge diameter, was about 100,000. The model was immersed in the flow field downstream of an approximately half scale model of a can-type combustor from a low NO(x), ground based power-generating turbine. The tests were conducted with room temperature air; no fuel was added. Room air flowed into the combustor through six vane type fuel/air swirlers. The combustor can contained no dilution holes. The fuel/air swirlers all swirled the incoming airflow in a counter clockwise direction (facing downstream). A 5-hole probe flow field survey in the plane of the model stagnation point showed the flow was one big vortex with flow angles up to 36° at the outer edges of the rectangular test section. Hot wire measurements showed test section flow had very high levels of turbulence, around 28.5 percent, and had a relatively large axial-length scale-to-leading edge diameter ratio of 0.5. X-wire measurements showed the turbulence to be nearly isotropic. Stagnation heat transfer augmentation over laminar levels was around 77 percent and was about 14 percent higher than predicted by a previously developed correlation for isotropic grid generated turbulence.

Author

Augmentation; Stagnation Point; Stagnation Flow; Flow Distribution; Heat Transfer; Gas Turbines; Turbulent Flow; Isotropic Turbulence

20000081748 NASA Glenn Research Center, Cleveland, OH USA

Active Combustion Control for Aircraft Gas Turbine Engines

DeLaat, John C., American Inst. of Aeronautics and Astronautics, USA; Breisacher, Kevin J., American Inst. of Aeronautics and Astronautics, USA; Saus, Joseph R., American Inst. of Aeronautics and Astronautics, USA; Paxson, Daniel E., American Inst. of Aeronautics and Astronautics, USA; July 2000; 16p; In English; 36th; 36th Joint Propulsion Conference and Exhibition, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 523-26-13

Report No.(s): NASA/TM-2000-210346; NAS 1.15:210346; E-12393; AIAA Paper 2000-3500; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lean-burning combustors are susceptible to combustion instabilities. Additionally, due to non-uniformities in the fuel-air mixing and in the combustion process, there typically exist hot areas in the combustor exit plane. These hot areas limit the operating temperature at the turbine inlet and thus constrain performance and efficiency. Finally, it is necessary to optimize the fuel-air ratio and flame temperature throughout the combustor to minimize the production of pollutants. In recent years, there has been considerable activity addressing Active Combustion Control. NASA Glenn Research Center's Active Combustion Control Technology effort aims to demonstrate active control in a realistic environment relevant to aircraft engines. Analysis and experiments are tied to aircraft gas turbine combustors. Considerable progress has been shown in demonstrating technologies for

Combustion Instability Control, Pattern Factor Control, and Emissions Minimizing Control. Future plans are to advance the maturity of active combustion control technology to eventual demonstration in an engine environment.

Author

Active Control; Combustion Control; Fuel Control; Burning Rate; Combustion Stability; Combustion Chemistry; Combustion; Reaction Kinetics

20000081761 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Bayesian Belief Networks for Fault Identification in Aircraft Gas Turbines

Reed, Aaron T.; Jun. 15, 2000; 18p; In English

Report No.(s): AD-A378859; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the methodology for usage of Bayesian Belief Networks (BBNs) in fault detection for aircraft gas turbine engines. First, the basic theory of BBNs is discussed, followed by a discussion on the application of this theory to a specific engine. In particular, the selection of faults and the means by which operating regions for the BBN system are chosen are analyzed. This methodology is then illustrated using the GE CFM56-7 turbofan engine as an example.

DTIC

Belief Networks; Fault Detection; Gas Turbine Engines; Engine Monitoring Instruments

20000082027 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Exhaust Exposure Potential From the Combustion of JP-8 Jet Fuel in C-130 Engines

Pirkle, Paul S., III; May 31, 2000; 84p; In English

Report No.(s): AD-A378788; AFIT-00-179; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This project was requested by the Air Force Institute of Environment Safety and Health Risk Analysis to evaluate personal exposure to turbine engine exhaust. Quantifiable indicators of exhaust exposure were identified based on selected components of turboprop exhaust - soot-borne polycyclic aromatic hydrocarbons (PAH), elemental carbon particulate matter and carbon dioxide. Since there were no U.S. occupational exposure limits (OELs) for the first two components, working OELs were chosen by analogy to assess exposure potential. Airborne concentrations of soot-borne PAH were compared with a working OEL of 0.2 mg/cu m(3) and elemental carbon particulate matter with 0.05 mg/cu m(3), both on an 8-hour time weighted average (TWA) basis. No PAH were detected with NIOSH Analytical Method 5506. Breathing zone levels were less than 10 percent of working OELs. Estimated transient elemental carbon particulate concentrations periodically exceeded excursion limits for the working OEL (0.15 mg/cu m(3) for 30-min excursions and 0.25 mg/cu m(3) for 5-minute excursions). The photoelectric aerosol sensor (PAS) is a quantitative instrument known to respond to particle-bound PAH. The PAS is useful for identifying turbine engine exhaust concentration gradients throughout the workplace. Its short averaging time permits correlation of work activities with exposure events and allows documenting process conditions in a near real-time and time history fashion. This instrument needs more developmental work before its response can be stated in terms of an OEL for turbine engine exhaust. TWA elemental carbon concentrations were highly correlated with computed averages of PAS output.

DTIC

JP-8 Jet Fuel; Turbojet Engines; Turboprop Engines; C-130 Aircraft; Exhaust Emission; Exposure; Health

20000083960 NASA Glenn Research Center, Cleveland, OH USA

An Overview of the NASA Aviation Safety Program Propulsion Health Monitoring Element

Simon, Donald L., Army Research Lab., USA; July 2000; 16p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 577-30-20; DA Proj. 1L1-61102-AH-45

Report No.(s): NASA/TM-2000-210348; E-12396; NAS 1.15:210348; ARL-TR-2272; AIAA Paper 2000-3624; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Aviation Safety Program (AvSP) has been initiated with aggressive goals to reduce the civil aviation accident rate, to meet these goals, several technology investment areas have been identified including a sub-element in propulsion health monitoring (PHM). Specific AvSP PHM objectives are to develop and validate propulsion system health monitoring technologies designed to prevent engine malfunctions from occurring in flight, and to mitigate detrimental effects in the event an in-flight malfunction does occur. A review of available propulsion system safety information was conducted to help prioritize PHM areas to focus on under the AvSP. It is noted that when a propulsion malfunction is involved in an aviation accident or incident, it is often a contributing factor rather than the sole cause for the event. Challenging aspects of the development and implementation of PHM technology such as cost, weight, robustness, and reliability are discussed. Specific technology plans are overviewed including vibration diagnostics, model-based controls and diagnostics, advanced instrumentation, and general aviation propulsion system

health monitoring technology. Propulsion system health monitoring, in addition to engine design, inspection, maintenance, and pilot training and awareness, is intrinsic to enhancing aviation propulsion system safety.

Author

Aircraft Safety; Flight Safety; Aircraft Accidents; Malfunctions; Collision Avoidance; Safety Factors; Systems Health Monitoring; Propulsion System Performance

20000085868 NASA Glenn Research Center, Cleveland, OH USA

Performance of an Active Noise Control System for Fan Tones Using Vane Actuators

Sutliff, Daniel L., AYT Corp., USA; Curtis, Alan R. D., Materials Systems, Inc., USA; Heidelberg, Laurence J., NASA Glenn Research Center, USA; Remington, Paul J., Bolt, Beranek, and Newman, Inc., USA; July 2000; 30p; In English; 6th; 6th Aeroacoustics Conference and Exhibit, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 522-81-11

Report No.(s): NASA/TM-2000-210229; NAS 1.15:210229; E-12348; AIAA Paper 2000-1906; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An Active Noise Control (ANC) system for ducted fan noise was built that uses actuators located in stator vanes. The custom designed actuators are piezoelectric benders manufactured using THUNDER technology. The ANC system was tested in the NASA Active Noise Control Fan rig. A total of 168 actuators in 28 stator vanes were used (six per vane). Simultaneous inlet and exhaust acoustic power level reductions were demonstrated for a fan modal structure that contained two radial modes in each direction. Total circumferential mode power levels were reduced by up to 9 dB in the inlet and 3 dB in the exhaust. The corresponding total 2BPF tone level reductions were by 6 dB in the inlet and 2 dB in the exhaust. Farfield sound pressure level reductions of up to 17 dB were achieved at the peak mode lobe angle. The performance of the system was limited by the constraints of the power amplifiers and the presence of control spillover. Simpler control/actuator systems using carefully selected subsets of the full system and random simulated failures of up to 7% of the actuators were investigated. (The actuators were robust and none failed during the test). Useful reductions still occurred under these conditions.

Author

Acoustic Measurement; Aerodynamic Noise; Noise Reduction; Vanes; Fan Blades; Ducted Fans

20000088494 General Electric Co., Aircraft Engines, Cincinnati, OH USA

Multi-Disciplinary Design Optimization Using WAVE Final Report

Irwin, Keith, General Electric Co., USA; June 2000; 20p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-98004; RTOP 509-10-11

Report No.(s): NASA/CR-2000-210218; E-12337; NAS 1.26:210218; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current preliminary design tools lack the product performance, quality and cost prediction fidelity required to design Six Sigma products. They are also frequently incompatible with the tools used in detailed design, leading to a great deal of rework and lost or discarded data in the transition from preliminary to detailed design. Thus, enhanced preliminary design tools are needed in order to produce adequate financial returns to the business. To achieve this goal, GEAE has focused on building the preliminary design system around the same geometric 3D solid model that will be used in detailed design. With this approach, the preliminary designer will no longer convert a flowpath sketch into an engine cross section but rather, automatically create 3D solid geometry for structural integrity, life, weight, cost, complexity, producibility, and maintainability assessments. Likewise, both the preliminary design and the detailed design can benefit from the use of the same preliminary part sizing routines. The design analysis tools will also be integrated with the 3D solid model to eliminate manual transfer of data between programs. GEAE has aggressively pursued the computerized control of engineering knowledge for many years. Through its study and validation of 3D CAD programs and processes, GEAE concluded that total system control was not feasible at that time. Prior CAD tools focused exclusively on detail part geometry and Knowledge Based Engineering systems concentrated on rules input and data output. A system was needed to bridge the gap between the two to capture the total system. With the introduction of WAVE Engineering from UGS, the possibilities of an engineering system control device began to formulate. GEAE decided to investigate the new WAVE functionality to accomplish this task. NASA joined GEAE in funding this validation project through Task Order No. 1. With the validation project complete, the second phase under Task Order No. 2 was established to develop an associative control structure (framework) in the UG WAVE environment enabling multi-disciplinary design of turbine propulsion systems. The

capabilities of WAVE were evaluated to assess its use as a rapid optimization and productivity tool. This project also identified future WAVE product enhancements that will make the tool still more beneficial for product development.

Author

Three Dimensional Models; Computer Aided Design; Multidisciplinary Design Optimization; Design Analysis; Gas Turbines; Engine Design

20000088653 General Electric Co., Advanced Engineering Programs Dept., Cincinnati, OH USA

Probabilistic Rotor Design System (PRDS): Gas Turbine Engine Design *Final Report, 23 Jan. 1991 - 12 Dec. 1998*

Roth, P. G.; Dec. 1998; 278p; In English

Contract(s)/Grant(s): F33615-90-C-2070; AF Proj. 3066

Report No.(s): AD-A378908; AFRL-PR-WP-TR-1999-2122; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The USAF Probabilistic Rotor Design System (PRDS) contract (F33615-90-C-2070) was designed to develop, validate and demonstrate a probabilistic alternative to existing deterministic design philosophy. This report is a final summary of the work done for disk applications (a second team at GE Aircraft Engines is continuing work on a contract extension focusing on blades). Included in this report are: (1) A summary of physical mechanisms relevant to disk design. (2) A review of records on disk failures. (3) Extensive discussion of the concept of risk based design and recommendations for applications. (4) Description of a Probabilistic Design Analysis System developed by GE. (5) In depth review of validation testing of Probabilistic Fracture Mechanics base on fatigue testing of seeded push-pull and model disk specimens. (6) An introduction to risk based design optimization with an example application. (7) Specific suggestions for incorporating elements of risk based design into the Engine Structural Integrity Program (ENSIP, MIL SPEC 1783).

DTIC

Design Analysis; Engine Design; Gas Turbine Engines; Aircraft Engines; Rotors

20000090563 NASA Langley Research Center, Hampton, VA USA

Undulated Nozzle for Enhanced Exit Area Mixing

Seiner, John M., Inventor, NASA Langley Research Center, USA; Gilinsky, Mikhail M., Inventor, NASA Langley Research Center, USA; Jul. 04, 2000; 20p; In English; Continuation of US-Patent-Appl-SN-850572, filed 2 May 1997 and provisional US-Patent-Appl-SN-020966, filed 12 Jun. 1996

Patent Info.: Filed 2 May 1997; NASA-Case-LAR-15215-1; US-Patent-6,082,635; US-Patent-Appl-SN-848851; US-Patent-Appl-SN-850572; US-Patent-Appl-SN-020966; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A nozzle having an undulating surface for enhancing the mixing of a primary flow with a secondary flow or ambient air, without requiring an ejector. The nozzle includes a nozzle structure and design for introducing counter-rotating vorticity into the primary flow either through (i) internal surface corrugations where an axisymmetric line through each corrugation is coincident with an axisymmetric line through the center of the flow passageway or (ii) through one or more sets of alternating convexities and cavities in the internal surface of the nozzle where an axisymmetric line through each convexity and cavity is coincident with an axisymmetric line through the center of the flow passageway, and where the convexities contract from the entrance end towards the exit end. Exit area mixing is also enhanced by one or more chevrons attached to the exit edge of the nozzle. The nozzle is ideally suited for application as a jet engine nozzle. When used as a jet engine nozzle, noise suppression with simultaneous thrust augmentation/minimal thrust loss is achieved.

Official Gazette of the U.S. Patent and Trademark Office

Engine Noise; Jet Engines; Nozzle Design; Nozzle Geometry

20000091010 NASA Marshall Space Flight Center, Huntsville, AL USA

Marquardt's Mach 4.5 Supercharged Ejector Ramjet (SERJ) High-Performance Aircraft Engine Project: Unfulfilled Aspirations Ca.1970

Escher, William J. D., Science Applications International Corp., USA; Roddy, Jordan E., Science Applications International Corp., USA; Hyde, Eric H., NASA Marshall Space Flight Center, USA; [2000]; 40p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-99060

Report No.(s): AIAA Paper 2000-3109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Supercharged Ejector Ramjet (SERJ) engine developments of the 1960s, as pursued by The Marquardt Corporation and its associated industry team members, are described. In just three years, engineering work on this combined-cycle powerplant type evolved, from its initial NASA-sponsored reusable space transportation system study status, into a U.S. Air Force/Navy-supported exploratory development program as a candidate 4.5 high-performance military aircraft engine. Bridging a productive transition

from the spaceflight to the aviation arena, this case history supports the expectation that fully-integrated airbreathing/rocket propulsion systems hold high promise toward meeting the demanding propulsion requirements of tomorrow's aircraft-like Spaceliner class transportation systems. Lessons to be learned from this "SERJ Story" are offered for consideration by today's advanced space transportation and combined-cycle propulsion researchers and forward-planning communities.

Author

Ejectors; Ramjet Engines; Rocket Engines; Aircraft Engines; Product Development; Production Engineering; Engine Design

20000091028 NASA Langley Research Center, Hampton, VA USA

Jet Nozzle Having Centerbody for Enhanced Exit Area Mixing

Seiner, John M., Inventor, NASA Langley Research Center, USA; Gilinsky, Mikhail M., Inventor, NASA Langley Research Center, USA; Jul. 20, 1999; 10p; In English; Provisional US-Patent-Appl-SN-016741, filed 2 May 1996

Patent Info.: Filed 2 May 1997; NASA-Case-LAR-15518-1; US-Patent-5,924,632; US-Patent-Appl-SN-850572; US-Patent-Appl-SN-016741; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A nozzle arrangement includes a nozzle and a centerbody. The longitudinal axis of the centerbody is coaxially aligned with the nozzle. The centerbody has a free end portion shaped to create vortices in exhaust exiting the exit area. The vortices enhance mixing action in the exhaust and reduce exhaust noise while augmenting thrust.

Official Gazette of the U.S. Patent and Trademark Office

Jet Engines; Exhaust Nozzles; Fuel Injection; Patents; Inventions

20000092097 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

Choice of Material in Flying Gas Turbines *Materiaalkeuze voor Vliegende Gasturbines*

Kolkman, H. K.; Aug. 22, 1996; 16p; In Dutch

Report No.(s): PB2000-106604; NLR-TP-96513-U; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available.

NTIS

Gas Turbine Engines; Aircraft Maintenance; Heat Resistant Alloys; Aircraft Construction Materials

20000092466 National Aerospace Lab., Tokyo Japan

Technical Report of National Aerospace Laboratory: Experimental Investigation of a Fuel-Cooled Flameholder for a Ramjet Engine Combustor

Kurosawa, Y.; Yamamoto, T.; Saito, T.; Tamaru, S.; May 1999; 28p; In Japanese

Report No.(s): PB2000-106816; NAL/TR-1384; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Basic studies of a ramjet engine combustor for the space plane were conducted at the National Aerospace Laboratory. This paper reports the results of experiments with hydrogen-fuel-cooled flameholders. Fuel cooling of the flameholders is necessary because the temperature of the incoming air is extremely high during high Mach number flight. Two kinds of fuel injection were tested for the flameholder, crosswise and flow-directional fuel injection. Visual observation and gas analysis of the flame showed that the former type of fuel injection made the flame unstable and caused blow-off when the combustor inlet velocity was increased to 80 m/s, possibly causing damage to the other flameholders. Flow-directional fuel injection demonstrated satisfactory performance over the required range of operation, albeit with narrow flame area.

NTIS

Flame Holders; Flames; Combustion Chambers; Ramjet Engines

20000093312 NASA Glenn Research Center, Cleveland, OH USA

Internal Designs Application for Inlet and Nozzle Aeroperformance Improvement

Gilinsky, M., Hampton Univ., USA; Blankson, I. M., NASA Glenn Research Center, USA; [2000]; 12p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG1-1835; NAG1-1936; NAG3-2249

Report No.(s): AIAA Paper 00-3315; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The following research results are based on development of an approach previously proposed by the authors for optimum nozzle design to obtain maximum thrust. The design was denoted a Telescope nozzle. A Telescope nozzle contains one or several internal designs of certain location, which are inserted at certain locations into a divergent conical or planar main nozzle near its exit. Such a design provides additional thrust augmentation over 20% by comparison with the optimum single nozzle of equivalent lateral area. What is more, recent experimental acoustic tests have discovered an essential noise reduction due to Telescope nozzles

application. In this paper, some additional theoretical results are presented for Telescope nozzles and a similar approach is applied for aeroperformance improvement of a supersonic inlet. In addition, a classic gas dynamics problem of a similar supersonic flow into a plate has been analyzed. In some particular cases, new exact analytical solutions are obtained for a flow into a wedge with an oblique shock wave. Numerical simulations were conducted for supersonic flow into a divergent portion of a 2D or axisymmetric nozzle with several plane or conical designs as well as into a 2D or axisymmetric supersonic inlet with a forebody. The 1st order Kryko-Godunov marching numerical scheme for inviscid supersonic flows was used. Several cases were tested using the NASA CFL3d code based on full Navier-Stokes equations. Numerical simulation results have confirmed essential benefits of Telescope design applications in propulsion systems.

Author

Inlet Nozzles; Propulsion System Performance; Nozzle Design; Computerized Simulation; Aerodynamics; Numerical Analysis

08

AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots.

20000080368 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

Pilot Comments From the Boeing High Speed Research Aircraft, Cycle 3, Simulation Study of the Effects of Aeroservoelasticity (LaRC.3)

Bailey, Melvin L., Editor, Lockheed Martin Engineering and Sciences Co., USA; July 2000; 254p; In English

Contract(s)/Grant(s): NAS1-19000; RTOP 537-08-23-21

Report No.(s): NASA/CR-2000-210307; NAS 1.26:210307; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This is a compilation of pilot comments from the Boeing High Speed Research Aircraft, Cycle 3, simulation study (LaRC.3) of the effects of aeroservoelasticity, conducted from October to December 1997 at NASA Langley Research Center. This simulation study was conducted using the Visual Motion Simulator. The comments are from direct tape transcriptions and have been edited for spelling only. These comments were made on tape following the completion of each flight card, immediately after the pilot was satisfied with his practice and data recording runs. Six pilots were used in the evaluation and they are identified as pilots A through F.

Author

Boeing Aircraft; Data Recording; Aeroservoelasticity; Simulation

20000080478 Cranfield Univ., Flight Test and Dynamics Group, Bedford, UK

Investigating the PIO-Susceptibility of the F-4C

Brieger, Oliver, Cranfield Univ., UK; June 2000; 102p; In English

Report No.(s): COA-0004; ISBN 1-86194-051-3; Copyright; Avail: Issuing Activity

Pilot Induced Oscillations are still a serious safety problem in aviation. Especially in regard of the continuous evolution of modern fly-by-wire flight control systems, PIOs seem to occur more frequently. Although test pilots, flight test engineers and handling qualities specialists have dealt with this phenomenon over the past three decades, it still is difficult to apprehend and all too often it catches pilots as well as engineers by surprise. This report gives a brief overview of the mechanisms and the contributing factors in pilot behavior, in aircraft dynamics and in the environment that lead to a PIO-condition. A great effort has been made over the years to develop reliable tools, analytically as well as experimentally, which are capable of identifying PIO-prone and PIO-resistant configurations. Five of the most acknowledged, state-of-the-art frequency and time domain criteria for evaluating PIO susceptibility, based on linear aircraft dynamics, are introduced and compared. These are the Neal and Smith Criterion (original definition), the Bandwidth/Pitch-Rate Overshoot Criterion, the Smith-Geddes Criterion, the Gibson Phase Rate Criterion and the Gibson Dropback Criterion. These Criteria are applied to two selected flight conditions of a linearized, small perturbations model of the F-4C (Phantom II) aircraft, based on the longitudinal equations of motion. The responses of the mathematical aircraft model, which is developed for this purpose using the state space method, are examined and verified with the MATLAB software package and the applicability/suitability of the criteria for this configuration is assessed. Finally, similarities and differences in the application of the criteria, the utilized criterion parameters and the obtained results are discussed. The objective of this exercise is to provide a consolidated review of current criteria for longitudinal PIO-evaluation.

Author

F-4 Aircraft; Pilot Induced Oscillation; Flight Characteristics; Aerodynamic Characteristics; Test Pilots

20000080528 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

Pilot Comments for High Speed Research Cycle 3 Simulations Study (LaRC.1)

Bailey, Melvin L., Editor, Lockheed Martin Engineering and Sciences Co., USA; July 2000; 302p; In English

Contract(s)/Grant(s): NAS1-19000; RTOP 537-08-23-21

Report No.(s): NASA/CR-2000-210306; NAS 1.26:210306; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This is a compilation of pilot comments from the Boeing High Speed Research Aircraft, Cycle 3 Simulation Study (LaRC.1) conducted from January to March 1997 at NASA Langley Research Center. This simulation study was conducted using the Visual Motion Simulator. The comments are direct tape transcriptions and have been edited for spelling only.

Author

High Speed; Supersonic Speed; Civil Aviation; Commercial Aircraft; Supersonic Transports

20000085030 NASA Langley Research Center, Hampton, VA USA

Identification of Low Order Equivalent System Models From Flight Test Data

Morelli, Eugene A., NASA Langley Research Center, USA; August 2000; 69p; In English

Contract(s)/Grant(s): RTOP 522-61-21

Report No.(s): NASA/TM-2000-210117; L-17995; NAS 1.15:210117; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Identification of low order equivalent system dynamic models from flight test data was studied. Inputs were pilot control deflections, and outputs were aircraft responses, so the models characterized the total aircraft response including bare airframe and flight control system. Theoretical investigations were conducted and related to results found in the literature. Low order equivalent system modeling techniques using output error and equation error parameter estimation in the frequency domain were developed and validated on simulation data. It was found that some common difficulties encountered in identifying closed loop low order equivalent system models from flight test data could be overcome using the developed techniques. Implications for data requirements and experiment design were discussed. The developed methods were demonstrated using realistic simulation cases, then applied to closed loop flight test data from the NASA F-18 High Alpha Research Vehicle.

Author

Experiment Design; Dynamic Models; System Identification

20000088589 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Case Study: Development of a Baseline Controller for Automatic Landing of an F-16 Aircraft Using Linear Matrix Inequalities (LMIs) Final Report

Seto, Danbing; Ferreira, Enrique; Marz, Theodore F.; May 2000; 66p; In English

Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A379857; CMU/SEI-99-TR-020; ESC*-TR-99-020; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this report, we present preliminary results on the design of the baseline controller for an F-16 aircraft automatic landing system using linear matrix inequalities (LMI)-based approaches. We start with a general study of aircraft control and dynamics to gain knowledge of the structure of an aircraft dynamic model and its inner loop control system. We then identify a linear model along the glide path for the inner loop control system in the simulator. With this linear model, the control objective is to solve a stabilization problem-stabilizing the aircraft along the glide path using linear state feedback controls. Expressing the stability criterion and the constraints in LMIs, we cast the stabilization problem as an optimization problem. Using the SDPSOL software package developed by Wu and Boyd, we solve this optimization problem for the control gain and stability region, which completes the controller design.

DTIC

Controllers; F-16 Aircraft; Inequalities; Automatic Pilots; Aircraft Landing; Linear Systems; Matrices (Mathematics)

20000089921 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Flutter Control of Wing Boxes Using Piezoelectric Actuators

Forster, Edwin E.; Aug. 1994; 62p; In English

Report No.(s): AD-A379278; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper examines the use of piezoelectric actuators to control supersonic flutter of wing boxes. Aluminum built-up wing boxes are used as examples to analyze the free vibration, aeroelastic, and control concepts associated with flutter control. Finite elements are used to calculate deflections due to input forces, the member stresses and strains, natural frequencies, and mode shapes. Linear strip theory with steady aerodynamics are applied to find the frequency coalescence of modes indicating flutter.

The variables of interest are the skin, web, and rib thicknesses associated with torsional rigidity, and the spar cap and vertical post areas associated with bending rigidity. Piezoelectric actuators are implemented in a configuration which generates torsional control of the wing box. Pole assignment concepts are applied to change the free vibration frequencies. A parametric study changing the free vibration frequencies using piezoelectric actuators is conducted to determine which thicknesses of skins, webs, and ribs will meet a specified flutter requirement. The addition of piezoelectric actuators will allow the flutter requirements to be met at smaller thicknesses of skins, webs, and ribs so that the overall weight of the wing box, including actuators, is decreased.

DTIC

Piezoelectricity; Actuators; Supersonic Flutter; Vibration Damping; Aeroelasticity; Control Theory; Finite Element Method; Free Vibration; Wings

20000091003 NASA Langley Research Center, Hampton, VA USA

Integrated Aero-Propulsion CFD Methodology for the Hyper-X Flight Experiment

Cockrell, Charles E., Jr., NASA Langley Research Center, USA; Englund, Walter C., NASA Langley Research Center, USA; Bittner, Robert D., FDC/NYMA, Inc., USA; Dilley, Arthur D., FDC/NYMA, Inc., USA; Jentink, Tom N., FDC/NYMA, Inc., USA; Frendi, Abdelkader, Alabama Univ., USA; 2000; 11p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4010; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computational fluid dynamics (CFD) tools have been used extensively in the analysis and development of the X-43A Hyper-X Research Vehicle (HXRV). A significant element of this analysis is the prediction of integrated vehicle aero-propulsive performance, which includes an integration of aerodynamic and propulsion flow fields. This paper describes analysis tools used and the methodology for obtaining pre-flight predictions of longitudinal performance increments. The use of higher-fidelity methods to examine flow-field characteristics and scramjet flowpath component performance is also discussed. Limited comparisons with available ground test data are shown to illustrate the approach used to calibrate methods and assess solution accuracy. Inviscid calculations to evaluate lateral-directional stability characteristics are discussed. The methodology behind 3D tip-to-tail calculations is described and the impact of 3D exhaust plume expansion in the afterbody region is illustrated. Finally, future technology development needs in the area of hypersonic propulsion-airframe integration analysis are discussed.

Author

Engine Airframe Integration; Aircraft Engines; Preflight Analysis; Supersonic Combustion Ramjet Engines

20000091032 Lockheed Martin Corp., Palmdale, CA USA

Flight Control Role in RLV Configuration Development

Youssef, Hussein, Lockheed Martin Corp., USA; Lee, Howard, Lockheed Martin Corp., USA; Chowdhry, Rajiv, Lockheed Martin Corp., USA; Cotting, Chris, Lockheed Martin Corp., USA; [2000]; 9p; In English, 14-16 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC8-115

Report No.(s): AIAA Paper 2000-3962; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new optimization technique was used to aide in the selection of aerodynamic surfaces and Thrust Vectoring Control (TVC) based on maximizing control margin during ascent and entry portions of the trajectory. In order to meet the mass fraction requirement of RLV (Reusable Launch Vehicle), every substructure needed to be carefully designed to minimize the dry mass. The trajectory was designed to deliver the payload required for each mission subject to thermal and structural constraints. At each point on the trajectory the angle of attack and Mach number pair was used to calculate the control power required to trim and to stabilize the vehicle. The new optimization technique was based on finding the configuration that minimizes the control power peaks along the entire trajectory.

Author

Flight Control; Stability Augmentation; Spacecraft Control; Control Stability; Reusable Launch Vehicles

20000091587 NASA Langley Research Center, Hampton, VA USA

A Parallel Approach to Optimum Actuator Selection With a Genetic Algorithm

Rogers, James L., NASA Langley Research Center, USA; [2000]; 11p; In English; Guidance, Navigation and Control, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4484; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent discoveries in smart technologies have created a variety of aerodynamic actuators which have great potential to enable entirely new approaches to aerospace vehicle flight control. For a revolutionary concept such as a seamless aircraft with no moving control surfaces, there is a large set of candidate locations for placing actuators, resulting in a substantially larger number of

combinations to examine in order to find an optimum placement satisfying the mission requirements. The placement of actuators on a wing determines the control effectiveness of the airplane. One approach to placement Maximizes the moments about the pitch, roll, and yaw axes, while minimizing the coupling. Genetic algorithms have been instrumental in achieving good solutions to discrete optimization problems, such as the actuator placement problem. As a proof of concept, a genetic has been developed to find the minimum number of actuators required to provide uncoupled pitch, roll, and yaw control for a simplified, untapered, unswept wing model. to find the optimum placement by searching all possible combinations would require 1,100 hours. Formulating the problem and as a multi-objective problem and modifying it to take advantage of the parallel processing capabilities of a multi-processor computer, reduces the optimization time to 22 hours.

Author

Actuators; Genetic Algorithms; Optimization; Parallel Processing (Computers); Flight Control; Aerospace Vehicles

20000092051 NASA Ames Research Center, Moffett Field, CA USA

Flight Control System Development for the BURRO Autonomous UAV

Colbourne, Jason D., California Polytechnic State Univ., USA; Frost, Chad R., California Polytechnic State Univ., USA; Tischler, Mark B., Army Aviation and Missile Command, USA; Ciolani, Luigi, NASA Ames Research Center, USA; Sahai, Ranjana, NASA Ames Research Center, USA; Tomoshofski, Chris, Kaman Aerospace Corp., USA; LaMontagne, Troy, Kaman Aerospace Corp., USA; [2000]; 11p; In English, 2000, Unknown; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): NCC2-983; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Developing autonomous flying vehicles has been a growing field in aeronautical research within the last decade and will continue into the next century. With concerns about safety, size, and cost of manned aircraft, several autonomous vehicle projects are currently being developed; uninhabited rotorcraft offer solutions to requirements for hover, vertical take-off and landing, as well as slung load transportation capabilities. The newness of the technology requires flight control engineers to question what design approaches, control law architectures, and performance criteria apply to control law development and handling quality evaluation. to help answer these questions, this paper documents the control law design process for Kaman Aerospace BURRO project. This paper will describe the approach taken to design control laws and develop math models which will be used to convert the manned K-MAX into the BURRO autonomous rotorcraft. With the ability of the K-MAX to lift its own weight (6000 lb) the load significantly affects the dynamics of the system; the paper addresses the additional design requirements for slung load autonomous flight. The approach taken in this design was to: 1) generate accurate math models of the K-MAX helicopter with and without slung loads, 2) select design specifications that would deliver good performance as well as satisfy mission criteria, and 3) develop and tune the control system architecture to meet the design specs and mission criteria. An accurate math model was desired for control system development. The Comprehensive Identification from Frequency Responses (CIFER(R)) software package was used to identify a linear math model for unloaded and loaded flight at hover, 50 kts, and 100 kts. The results of an eight degree-of-freedom CIFER(R)-identified linear model for the unloaded hover flight condition are presented herein, and the identification of the two-body slung-load configuration is in progress.

Author

Flight Conditions; Flight Control; Autonomy; Control Systems Design; Design Analysis; Mathematical Models

20000093261 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Experimental Identification of Blimp Dynamics for Autonomous Flight Control Development

Goto, Norihiro, Kyushu Univ., Japan; Kijima, Katsuro, Kyushu Univ., Japan; Aso, Shigeru, Kyushu Univ., Japan; Hokamoto, Shinji, Kyushu Univ., Japan; Fujita, Koki, Kyushu Univ., Japan; Yamasaki, Takeshi, Kyushu Univ., Japan; Akamine, Naoshi, Kyushu Univ., Japan; Kawashima, Mitsutoyo, Kyushu Univ., Japan; Fujita, Hirofumi, Kyushu Univ., Japan; Technology Reports of Kyushu University; July 2000; ISSN 0023-2718; Volume 73, No. 4, pp. 329-335; In Japanese; Copyright; Avail: Issuing Activity

The project of developing a mine detection system using blimps is in progress as one of Kyushu University's Interdisciplinary Programs in Education and Project in Research Development (P & P). It is aimed at putting to practical use a technique to autonomously detect landmines and mark their positions. For developing flight control systems of a blimp, a series of experiments has been conducted to identify the dynamics of a blimp. This paper addresses the blimp configuration developed for the project, experimental set-up for the identification, and the results of the identification in comparison with theoretical estimation. Based on the identified dynamics autonomous flight control systems are to be addressed in the future.

Author

Mine Detectors; Automatic Flight Control

20000093945 NASA Langley Research Center, Hampton, VA USA

Separation Control at Flight Reynolds Numbers: Lessons Learned and Future Directions

Pack, LaTunia G., NASA Langley Research Center, USA; Seifert, Avi, Tel-Aviv Univ., Ramat-Aviv, Israel; [2000]; 20p; In English; Fluids 2000, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 2000-2542; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Active separation control, using periodic excitation, was studied experimentally at high Reynolds numbers. The effects of compressibility, mild sweep, location of excitation slot and steady momentum transfer on the efficacy of the method were identified. Tests conducted at chord Reynolds numbers as high as 40×10^6 demonstrated that active control using oscillatory flow excitation can effectively delay flow separation from, and reattach separated flow to aerodynamic surfaces at flight conditions. The effective frequencies generate one to four vortices over the controlled region at all times, regardless of the Reynolds number. The vortices are initially amplified by the separated shear-layer, and after initiating reattachment, the strength of the vortices decay as they are convected downstream. Large amplitude, low frequency vortices break down to smaller ones upon introduction at the excitation slot. The effects of steady mass transfer were compared to those of periodic excitation. It was found that steady blowing is significantly inferior to periodic excitation in terms of performance benefits and that the response to steady blowing is abrupt, and therefore undesirable from a control point of view. Steady suction and periodic excitation are comparable in effectiveness and both exhibit a gradual response to changes in the magnitude of the control input. The combination of weak steady suction and periodic excitation is extremely effective while the addition of steady blowing could be detrimental. Compressibility effects are weak as long as separation is not caused by a shock-wave/boundary-layer interaction. The undesirable effects of the shock-induced separation could be alleviated by the introduction of periodic excitation upstream of the shock wave, inside the region of supersonic flow. The effects of mild sweep were also studied and periodic excitation was found to be very effective in reattaching three-dimensional separated flow. Scaling laws that correlate 2D and 3D controlled flows were tested and verified. Several performance benefits could be gained by applying the method to existing configurations, but it is expected that the full potential of the method can only be realized through the design of new configurations. A comprehensive, fully turbulent, database was generated in order to guide the development, and enable validation, of candidate unsteady CFD design tools.

Author

Boundary Layer Separation; Reattached Flow; Three Dimensional Flow; Two Dimensional Flow; Flow Distribution; Control Surfaces; Flight Conditions; High Reynolds Number

20000094038 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA

Rapid Prototyping and Evaluation of Control System Designs for Manned and Unmanned Applications

Mansur, M. Hossein, Army Aviation and Missile Command, USA; Frye, Michael, University of Southern California, USA; Montegut, Michael, Raytheon STX Corp., USA; [2000]; 4p; In English; 56th; Forum and Technology Display, 2-4 May 2000, Virginia Beach, VA, USA; Sponsored by American Helicopter Society, Inc., USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The development and optimization of flight control systems for modern fixed- and rotary- wing aircraft consume significant time and cost during aircraft development. Similarly, as unmanned aerial vehicles perform more complex tasks, sometimes autonomously, the control system design requirements for this class of vehicles, and the corresponding time and cost requirements, are also becoming significant. Therefore, for both manned and unmanned vehicles, substantial program savings can be achieved if integrated design and optimization tools are employed to shorten the design and flight-test cycle for new or upgraded control systems. To bring about this reduction in the length of the design-cycle, and therefore its cost, Madab and Simulink are being used to implement block diagrams and to rapidly evaluate the expected responses of the completed systems. In conjunction, CONDUIT (CONTROL Designer's Unified Interface) is being used to enable the controls engineers to optimize their control laws and ensure that all the relevant quantitative criteria are satisfied.

Derived from text

Control Systems Design; Pilotless Aircraft; Prototypes; Manned Space Flight

20000094323 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Three Dimensional Formation Flight Control

Hall, James K.; Mar. 2000; 94p; In English

Report No.(s): AD-A380348; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Automating the control of an aircraft flying in formation necessitates the extension of the theory of formation flight control to allow for three dimensional maneuvers. The formation was modeled as a two-aircraft, leader and wing span, formation. Both aircraft has its own three dimensional, rotating and translating, Cartesian axes system, with special attention being given to the motion of the leader in relation to the wing span. The controller operated using the equations of motion expressed in the rotating

reference frame of the wing aircraft. The control system has seven states, three inputs and three disturbance signals to model the dynamics of the formation in three dimensional space. The control law employed was the feedback of the difference between in actual separation distance and the commanded separation distance to affect changes in thrust, lift, and roll rate. The control system incorporated proportional, integral, and derivative control elements, each with separate gains, to achieve and maintain the specified formation geometry despite various maneuvers flown by the leader. Simulated maneuvers included: an initial displacement of the wing span away from the formation geometry, and changes in the leader's velocity, altitude, and heading. For each maneuver, the controller performance was sufficient to maintain the commanded formation geometry.

DTIC

Flight Control; Control Theory

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems.

20000081740 Navy Technology Center for Safety and Survivability, Washington, DC, DC USA

Effects of Water Sprinklers on the Performance of Low Level AFFF Aircraft Hangar Fire Suppression Systems *Interim Report*

Back, G. G., Navy Technology Center for Safety and Survivability, USA; Parker, A. J., Navy Technology Center for Safety and Survivability, USA; Scheffey, J. L., Navy Technology Center for Safety and Survivability, USA; Williams, F. W., Navy Technology Center for Safety and Survivability, USA; Gott, J. E., Navy Technology Center for Safety and Survivability, USA; May 22, 2000; 116p; In English

Report No.(s): AD-A378493; NRL/MR/6180--00-8456; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

A series of full-scale fire tests was conducted to evaluate the effect that overhead water-only sprinklers have on the effectiveness of a low level AFFF fire suppression system. The combined overhead water-only sprinkler and low level AFFF system is being considered as a new protection scheme for U.S. Navy aircraft hangars. The results show that the operation of overhead water sprinklers up to 10.2 Lpm/sq m (0.25 gpm/sq ft) does not degrade the performance of a low level system during AFFF discharge (4.0 Lpm/sq m (0.1 gpm/sq ft)). Based on the results of these tests, the design criteria for Navy hangar protection may be revised to incorporate AFFF application from only the low level system, combined with overhead closed-head guide response water sprinklers.

DTIC

Fire Fighting; Hangars; Fire Extinguishers; Foams; Fire Prevention

20000082198 Army Engineer Research and Development Center, Vicksburg, MS USA

Response of Granular Layers in Flexible Pavements Subjected to Aircraft Loadings

Smith, Donald M., Army Engineer Research and Development Center, USA; May 2000; 267p; In English

Report No.(s): AD-A379144; ERDC/GL,TR-00-3; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

Airfield pavement design is a complex blend of relatively simple linear elastic theory, fatigue concepts, correlations with small-scale and full-scale and full-scale tests, and pragmatic adjustments to reflect observations of in-service pavements. The granular base and subbase have always posed the most difficult analytical problem in traditional pavement design methodologies. For this reason, the granular layers have never been treated explicitly in design as have the asphalt concrete (AC) layer and subgrade layer, which have used predictive models for cracking in the AC and rutting in the subgrade as a function of linear-elastic strain and material properties. Instead, these granular layers were carefully specified in terms of gradation, plasticity, and in-situ density to minimize deformation under traffic. However, today's designers are being asked to predict pavement performance under a variety of nonstandard conditions. This is a far more complex task than simply providing safe thickness and specifications for the material. To deal with this new challenge, the design community must have material models that predict cumulative deformations under repetitive aircraft loads. In order to apply these material models, mechanical response data are required to calibrate the necessary model parameters. The parameters used to define strength, failure, and deformation properties must be defined for any material to be modeled. This report describes the constitutive model requirements, laboratory tests, and analysis used in developing a response model for an unbound granular base course typical of an airfield pavement.

DTIC

Pavements; Landing Sites; Runways; Aircraft Landing; Asphalt; Concretes; Finite Element Method

20000083064 Army Space and Missile Defense Command, Huntsville, AL USA
Mountaintop Surveillance Sensor Test Integration Center Facility, Kauai, Hawaii *Final Report*
Craven, Tom; May 2000; 184p; In English
Report No.(s): AD-A378168; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

The purpose of the Proposed Action is to create the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility to provide a ground-based test capability to evaluate and compare new and updated sensor technologies. The EA addresses three sites: the Pacific Missile Range Facility-(PMRF) Kokee, PMRF-Makaha Ridge, and PMRF-Main Base. All sites are located on the Island of Kauai, Hawaii. The tower originally installed and removed as part of the Mountaintop Sensor Integration and Test program would be reinstalled at PMRF-Kokee. The existing radar antenna/pad would be modified to support sensors such as the Ultra High Frequency Electronically Scanned Array. Hardware and software systems would be developed and integrated. MSSTIC hardware would be installed and evaluated on existing towers at PMRF-Makaha Ridge. The hardware would be rotated between PMRF-Kokee and PMRF-Makaha Ridge approximately once every two years during the estimated 5-year test period. The sites would be returned to their original condition at the end of the testing period. Tests would involve using targets of opportunity such as aircraft and floating jammers. Facility support buildings could be constructed on the southern part of PMRF-Main Base within a 0.4-hectare (1-acre) area south of the existing Hawaii Air National Guard facility. If the program does not build on base, personnel would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.

DTIC

Surveillance; Radar Antennas; Antenna Arrays; Scanners; Optical Equipment; Radar Scanning; Radar Tracking; Tracking Stations; Ground Stations

20000086645 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Calibration of the Reference Velocity in the Test Section of the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory

Edwards, Craig D., Defence Science and Technology Organisation, Australia; Feb. 2000; 41p; In English
Report No.(s): AD-A377313; DSTO-TN-0248; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The measurement of wind velocity in the test section of the Low Speed Wind Tunnel is obtained from the measurement of dynamic pressure using two piezometer rings located at the entrance and exit of the tunnel contraction. Following the recent installation of a new contraction, a calibration of the dynamic pressure measurement system was performed to determine a new wind tunnel

DTIC

Wind Velocity Measurement; Wind Tunnel Tests; Wind Velocity

20000088495 NASA Glenn Research Center, Cleveland, OH USA
Application of Pressure-Sensitive Paint to Ice-Accreted Wind Tunnel Models

Bencic, Timothy J., NASA Glenn Research Center, USA; June 2000; 14p; In English; 38th; Aerospace Sciences, 10-14 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 519-20-53

Report No.(s): NASA/TM-2000-209942; E-12190; NAS 1.15:209942; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pressure-sensitive paint (PSP) has been successfully used to measure global surface pressures on an ice-accreted model in an icing wind tunnel at NASA Glenn Research Center. Until now, the PSP technique has been limited to use in normal wind tunnels and clear flight environments. This is the first known application of PSP directly to ice in subfreezing conditions. Several major objectives were achieved in these tests. The procedure for applying the coating in the subfreezing tunnel environment was verified. Inspection of the painted ice surface revealed that the paint did not alter the original ice shape and adhered well over the entire coated area. Several procedures were used to show that the paint responded to changes in air pressure and that a repeatable pressure-dependent calibration could be achieved on the PSP-coated surfaces. Differences in pressure measurements made simultaneously on the ice and the metal test model are not yet fully understood, and techniques to minimize or correct them are being investigated.

Author

Pressure Measurement; Ice Formation; Aircraft Icing; Luminescence; Paints; Wind Tunnel Tests; Wind Tunnel Models; Coatings

20000088510 Raytheon Training and Services Co., Mesa, AZ USA

Magnification of Imagery to Compensate for the Decrease in Perceived Size Associated With a 28-Inch Viewing Distance
Final Report, Oct. 1998-Oct. 1999

Pierce, Byron J., Air Force Research Lab., USA; Geri, George A., Raytheon Training and Services Co., USA; Nov. 1999; 11p; In English

Contract(s)/Grant(s): F41624-97-D-5000; AF Proj. 1123

Report No.(s): AD-A379327; AFRL-HE-AZ-SR-1999-0007; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report describes an experiment to compare the perceived size of collimated and uncollimated aircraft targets presented on typical flight simulator background imagery. It has recently been suggested that magnifying the size of imagery might improve the spatial detail of simulated targets. Such a magnification would also render uncollimated targets perceptually more similar in size to collimated targets. It has been questioned, however, whether a magnification using a viewing distance of 44 inches should be applied to a visual display system whose viewing distance is only 28 inches. The present experiment was performed to answer this question.

DTIC

Imagery; Targets; Viewing; Magnification; Aerospace Systems

20000089699 Oxford Univ., Dept. of Engineering Science, Oxford, UK

Application of Magnetic Suspension and Balance Systems to Hypersonic Wind Tunnel Testing

Owen, Andrew K., Oxford Univ., UK; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 171-183; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Wind tunnel model sting and shroud interference effects can be significant especially when testing small slender models which are required to simulate higher Knudsen number flows. Indeed, the presence of a sting of any size complicates all flowfield calculations since the model/sting geometry must also be numerically modeled. Thus, in an attempt to generate reliable low density aerothermodynamic data on test models in flows closer to the flight test ideal, the University of Oxford Low Density Wind Tunnel was recommissioned for an extensive series of experiments in which a magnetic suspension and balance system was used to obtain sting and shroud free model data. Test data were obtained over wide ranges of freestream Mach ($M=6-9$) Knudsen numbers (.001-0.3) on a wide variety of half angle cones at angle of attack, axially aligned cylinders of varying aspect ratio, and a model of the NASA Aerobrake vehicle. In this paper, the critical components and functions of the magnetic suspension and balance system along with the levitation and test measurement procedures will be described. Techniques used to achieve model stability through the active control of lift, pitch and drag, and lateral stability, including suitable shaping of the magnetic field, and strategic placement of ferromagnetic material within the test section will be discussed. Coil placement, coil current control loop, and the interactive magnetic field and optical control procedures required for successful levitation will also be described. Details of the optical model position detection and feedback system which were developed for both conical and axisymmetric model levitation and testing will also be presented along with the procedures developed for drag calibration and measurement. Some of the data that were acquired during the program will also be presented and they include: Aerodynamic heat transfer and recovery factor measurements on slender cones, and the drag data obtained for the NASA Aerobrake vehicle.

Derived from text

Magnetic Suspension; Wind Tunnel Models; Hypersonic Speed; Wind Tunnel Tests; Aerodynamic Balance

20000089700 National Aerospace Lab., Tokyo, Japan

Roll Motion Restraint System for NAL 0.6m MSBS: The 2nd Report

Kohno, Takashi, National Aerospace Lab., Japan; Sawada, Hideo, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 185-194; In English; See also 20000089691; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Suspending the wind tunnel model and controlling its motion in 5 degrees of freedom are realized in the National Aerospace Laboratory (NAL) 0.6m Magnetic Suspension Balance System (MSBS) but the roll motion of the model is not controlled yet. So a mechanical roll motion control system is designed for NAL 0.6m MSBS. This system has worked well in the test with the free rotation model hung by the string vertically and applied to the model suspended by MSBS. A wireless communication system between the system inside the model and the observer out of the test section has also been designed.

Derived from text

Constraints; Magnetic Suspension; Roll; Wind Tunnel Models; Wind Tunnel Tests; Aerodynamic Balance

20000089725 Mississippi State Univ., Dept. of Civil Engineering, Mississippi State, MS USA

Simulation of Wind Tunnel Forces Using Magnetic Suspension Technology

Sinno, R. Ralph, Mississippi State Univ., USA; Price, Thomas, Mississippi State Univ., USA; Nail, Bert, Mississippi State Univ., USA; Melton, Jason, Mississippi State Univ., USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 515-525; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Forces experienced by metal roofs under high wind conditions vary as a function of both time and space. Modeling a roof structure subdivided into segments or nodes accommodates spatial variation, for which magnetic suspended actuators are made to generate time-tailored forces equivalent to the wind-induced forces. In this study, each node consists of an induced electromagnetic actuator, an electronic control board, and a load cell for verification of the force produced. Short duration wind gust and the effect of such impulsive loading on a metal roof panel and the overall structural system are poorly incorporated in the present state-of-the-art in structural analysis and design. A full-scale testing facility for metal building roof components, now in operation at Mississippi State University, provides realistic forces that approximate those produced by high velocity winds from wind tunnel models.

Derived from text

Computerized Simulation; Wind Tunnel Tests; Magnetic Suspension; Loads (Forces); Full Scale Tests; Roofs

20000089737 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA

Design of a Magnetic Suspension and Balance System for the Princeton/ONR High Reynolds Number Testing Facility

Britcher, Colin P., Old Dominion Univ., USA; Gonzalez, Oscar, Old Dominion Univ., USA; Gray, Steven, Old Dominion Univ., USA; Smits, Alexander J., Princeton Univ., USA; Gomeiz, Oscar, Old Dominion Univ., USA; Barkley, James E., Old Dominion Univ., USA; Gray, Steven, Old Dominion Univ., USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 675-686; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Princeton University is currently constructing a specialized wind tunnel, the Princeton/ONR High Reynolds number Testing Facility (HRTF) to be used for aero/hydrodynamic testing of submersible shapes. The facility will operate at very high pressures, up to 230 atmospheres, and relatively low velocities. Old Dominion University is responsible for the design and commissioning of a Magnetic Suspension and Balance System (MSBS) for use with the HRTF. The HRTF design and operational characteristics will be briefly described, then the paper will concentrate on the design challenges faced by the MSBS. The most unusual problems are related to the fact that the electromagnets will be located outside the wind tunnel pressure shell, with position sensing and other hardware inside. The test section is constructed of stainless steel, so eddy currents generated by unsteady magnetic fields are a serious concern. It is shown by analysis and confirmed by measurements that the system is practical, provided the eddy current effects are properly modeled and accounted for in the control system design. Due to restricted access to the interior of the tunnel, the position sensing and control systems must be configured so as to reliably suspend models for long periods of time, with a variety of aero/hydrodynamic tests conducted in sequence. This leads to a relatively conservative choice of system configuration and hardware. The general design of the MSBS will be presented and plans for completion, commissioning, calibration and operation of the facility will be reviewed.

Author

High Reynolds Number; Magnetic Suspension; Wind Tunnel Tests; Design Analysis; Balance; Systems Engineering; Control Systems Design

20000093955 Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia

Design Philosophy and Material Choice for a Tuner in an Electromagnetic Reverberation Chamber

Weeks, Frank, Defence Science and Technology Organisation, Australia; Goldsmith, Kevin, Defence Science and Technology Organisation, Australia; February 2000; 24p; In English; Original contains color illustrations
Report No.(s): DSTO-TN-0257; AR-011-234; Copyright; Avail: Issuing Activity

This note addresses the design philosophy and material choice for the tuner in the Defence Science and Technology Organization (DSTO) combined-mode electromagnetic reverberation chamber. Restricting factors on the material choice are discussed, as well as tuner and gearbox design requirements.

Author

Design Analysis; Reverberation Chambers; Tuners; Transmissions (Machine Elements)

20000093971 Naval Postgraduate School, Monterey, CA USA

Warranty/Cannibalization Issues, Disruptive Forces in the Production and Maintainability of the E-2C Aircraft

Jacobs, Brian K.; Jun. 2000; 71p; In English

Report No.(s): AD-A379444; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis analyzes manufactures' warranties and cannibalization issues as they affect the maintainability on the E-2C aircraft. The analysis includes cannibalization structures, reasons why squadrons cannibalize, alternatives to cannibalization, cannibalization issues that affect maintenance personnel morale, and the disruptive effects of manufacturers' warranties to the fleet. The research identified that introducing production aircraft to the fleet without proper logistical support increases aircraft cannibalization and decreases maintainability. Cannibalization should not be used to increase aircraft readiness, since it doubles maintenance man-hours and depletes resources. Inconsistent Aviation Maintenance and Material Management (AV-3M) data contributes to aircraft cannibalization. An acquisition strategy that identifies logistics problems early will give the logistician an opportunity to decrease cannibalization.

DTIC

Aircraft Maintenance; E-2 Aircraft; Maintainability

10

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms.

20000083880 NASA Goddard Space Flight Center, Greenbelt, MD USA

Formation Flying With Decentralized Control in Libration Point Orbits

Folta, David, NASA Goddard Space Flight Center, USA; Carpenter, J. Russell, NASA Goddard Space Flight Center, USA; Wagner, Christoph, International Space Univ., Inc., France; [2000]; 20p; In English; 15th; Space Flight Dynamics, 26-30 Jun. 2000, Biarritz, France; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A decentralized control framework is investigated for applicability of formation flying control in libration orbits. The decentralized approach, being non-hierarchical, processes only direct measurement data, in parallel with the other spacecraft. Control is accomplished via linearization about a reference libration orbit with standard control using a Linear Quadratic Regulator (LQR) or the GSFC control algorithm. Both are linearized about the current state estimate as with the extended Kalman filter. Based on this preliminary work, the decentralized approach appears to be feasible for upcoming libration missions using distributed spacecraft.

Author

Libration; Linear Quadratic Regulator; Research; Orbit Determination; Flight Characteristics

20000094311 NASA Johnson Space Center, Houston, TX USA

Protecting the GEO Environment: Policies and Practices

Johnson, Nicholas L., NASA Johnson Space Center, USA; [1999]; 1p; In English

Contract(s)/Grant(s): RTOP 294-78-80; No Copyright; Avail: Issuing Activity; Abstract Only

The geosynchronous orbital regime has long been recognized as a unique space resource, dictating special measures to ensure its continuing use for future generations. During the past 20 years a variety of national and international policies have been developed to preserve this environment. A review of current practices involving the deployment and disposal of geosynchronous spacecraft, associated upper stages and apogee kick motors, and geosynchronous orbit transfer objects indicates both positive and negative trends. Most spacecraft operators are indeed performing end-of-mission maneuvers, but the boost altitudes normally fall short of policy guidelines. Russia, a major operator in geosynchronous orbit, maneuvers only 1 in 3 spacecraft out of the region, while China has never refired a spacecraft above GEO. The viability of voluntary protection measures for this regime depends upon the responsible actions of the aerospace community as a whole.

Author

Geosynchronous Orbits; Synchronous Satellites; Space Debris; Flight Hazards

20000085623 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

Flight Control Overview of STS-88, the First Space Station Assembly Flight

Hall, Robert, Draper (Charles Stark) Lab., Inc., USA; Kirchwey, Kim, Draper (Charles Stark) Lab., Inc., USA; Martin, Michael, Draper (Charles Stark) Lab., Inc., USA; Rosch, Gene, Draper (Charles Stark) Lab., Inc., USA; Zimpfer, Douglas, Draper (Charles Stark) Lab., Inc., USA; [1999]; 5p; In English

Contract(s)/Grant(s): NAS9-19556; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

When the Space Shuttle Endeavour undocked from the Zarya/Unity configuration on STS-88 it marked the completion of the most challenging shuttle mission to date and the beginning of an enormous task of assembling the International Space Station. The flight offered an array of complex dynamics and control related challenges to mate the American module 'Unity' to the Russian module 'Zarya'. Capability demonstrated on the flight included closed-loop thruster control in the presence of low frequency structural dynamics and mated-vehicle translational maneuvers in the presence of structural loads and thruster hardware constraints. The flight was a complete success from all aspects. This paper will give an overview of the flight control challenges encountered and the actual control performance observed for the on-orbit operations. Included will be the shuttle analysis and filtering strategies to ensure control system stability in the presence of low frequency flex-body dynamics.

Derived from text

Flight Control; Space Transportation System Flights; Systems Engineering; Dynamic Control; Dynamic Structural Analysis

20000085955 NASA Goddard Space Flight Center, Greenbelt, MD USA

Formation Flying In Highly Elliptical Orbits Initializing the Formation

Mailhe, Laurie, AI Solutions, Inc., USA; Schiff, Conrad, AI Solutions, Inc., USA; Hughes, Steven, NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; Space Flight Dynamics, Jun. 2000, Biarritz, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper several methods are examined for initializing formations in which all spacecraft start in a common elliptical orbit subsequent to separation from the launch vehicle. The tetrahedron formation used on missions such as the Magnetospheric Multiscale (MMS), Auroral Multiscale Midex (AMM), and Cluster is used as a test bed. Such a formation provides full three degrees-of-freedom in the relative motion about the reference orbit and is germane to several missions. The type of maneuver strategy that can be employed depends on the specific initial conditions of each member of the formation. Single-impulse maneuvers based on a Gaussian variation-of-parameters (VOP) approach, while operationally simple and intuitively-based, work only in a limited sense for a special class of initial conditions. These 'tailored' initial conditions are characterized as having only a few of the Keplerian elements different from the reference orbit. Attempts to achieve more generic initial conditions exceed the capabilities of the single impulse VOP. For these cases, multiple-impulse implementations are always possible but are generally less intuitive than the single-impulse case. The four-impulse VOP formalism discussed by Schaub is examined but smaller delta-V costs are achieved in our test problem by optimizing a Lambert solution.

Author

Flight Control; Spacecraft Control; Elliptical Orbits; Spacecraft Orbits

20000090554 NASA Marshall Space Flight Center, Huntsville, AL USA

Blade Surface Pressure Distributions in a Rocket Engine Turbine: Experimental Work With On-Blade Pressure Transducers

Hudson, Susan T., Mississippi State Univ., USA; Zoladz, Thomas F., NASA Marshall Space Flight Center, USA; Griffin, Lisa W., NASA Marshall Space Flight Center, USA; [2000]; 13p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3239; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Understanding the unsteady aspects of turbine rotor flowfields is critical to successful future turbine designs. A technology program was conducted at NASA's Marshall Space Flight Center to increase the understanding of unsteady environments for rocket engine turbines. The experimental program involved instrumenting turbine rotor blades with surface-mounted high frequency response pressure transducers. The turbine model was then tested to measure the unsteady pressures on the rotor blades. The data obtained from the experimental program is unique in three respects. First, much more unsteady data was obtained (several minutes per set point) than has been possible in the past. Also, two independent unsteady data acquisition systems and fundamental signal processing approaches were used. Finally, an extensive steady performance database existed for the turbine model. This allowed an evaluation of the effect of the on-blade instrumentation on the turbine's performance. This unique data set, the lessons learned for acquiring this type of data, and the improvements made to the data analysis and prediction tools will contribute to future turbine programs such as those for reusable launch vehicles.

Author

Pressure Distribution; Turbine Engines; Rocket Engines; Turbine Blades; Pressure Sensors; Unsteady Aerodynamics

20000091016 Hampton Univ., VA USA

Acoustics and Aeroperformance of Nozzles With Screwdriver Shaped and Axisymmetric Plugs

Gilinsky, M., Hampton Univ., USA; Kouznetsov, V. M., Tsentralni Aerogidrodinamicheskii Inst., USSR; Nark, D. M., Hampton Univ., USA; [1998]; 52p; In English; 4th; 4th Aeroacoustics Conference, 2-4 Jun. 1998, Toulouse, France; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG1-1835; CRDF-RE2-136; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The recent experimental and numerical tests of corrugated nozzles have shown some acoustic and thrust benefits relative to traditional round nozzles. For example, a Bluebell nozzle which was obtained by 3D nozzle design incorporating a corrugated cross section nozzle shape with a sinusoidal lip line nozzle edge, can provide an acoustic benefit up to 4dB with about a 1% thrust augmentation. In references, this effect was explained as being the result of the corrugated design producing more efficient mixing of the exhausted jet with ambient air. Based on this argument, the authors have proposed the application of this concept for a centerbody (plug) which can form several vortices downstream from the centerbody. Several different corrugated designs are proposed and described in detail in this paper. The main design is a Screwdriver shaped centerbody or plug (SCR) which was tested experimentally and numerically. The acoustic tests were conducted in the anechoic chamber of the Central AeroHydrodynamics Institute (TsAGI, Moscow) under Civilian Research and Development Foundation (CRDF) grant. These experiments have shown an essential acoustic benefit of about 10-13% with the application of the co-annular nozzles by comparison with the reference round nozzle with the same mass flow rate. However, the expected acoustic benefits with the application of the 4-petal Screwdriver shaped centerbody were not obtained by comparison with the reference axisymmetric centerbody (CON) having the same length and the same cross section areas at the same distance from the nozzle throat. Moreover, for some angles ($\Theta = 60$ deg and 90 deg) noise increase was observed (about 1-3%). These tests will be continued with the goal of obtaining better acoustic results. In particular, acoustic characteristics are hoped to be improved by moving the centerbody into the nozzle and using penetrable walls for the SCR and/or for the main nozzle. Preliminary results for such approach are very promising. Aeroperformance effects were analyzed numerically. The nozzle thrust, calculations were based on a full Navier-Stokes equations solver (NSE), and both full and marching Euler codes: CFL3D, CRAFT, and Krayko-Godunov. Grid preparation and its optimization were conducted using GRIDGEN and our own codes. The general conclusion of this numerical analysis is some thrust loss with the application of SCR design (about 1 - 1.5%). But, again, some constructive features of SCR design give some promising perspectives for its application in aviation and domestic industries.

Author

Centerbodies; Navier-Stokes Equation; Nozzle Design; Plugs; Shapes; Computational Fluid Dynamics; Noise Reduction; Aircraft Noise; Engine Noise; Performance Tests

20000091021 NASA Marshall Space Flight Center, Huntsville, AL USA

Raman Gas Species Measurements in Hydrocarbon-Fueled Rocket Engine Injector Flows

Wehrmeyer, Joseph, Vanderbilt Univ., USA; Hartfield, Roy J., Jr., Auburn Univ., USA; Trinh, Huu P., NASA Marshall Space Flight Center, USA; Dobson, Chris C., NASA Marshall Space Flight Center, USA; Eskridge, Richard H., NASA Marshall Space Flight Center, USA; [2000]; 8p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NASA Order H-35139-D

Report No.(s): AIAA Paper 2000-3391; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Rocket engine propellant injector development at NASA-Marshall includes experimental analysis using optical techniques, such as Raman, fluorescence, or Mie scattering. For the application of spontaneous Raman scattering to hydrocarbon-fueled flows a technique needs to be developed to remove the interfering polycyclic aromatic hydrocarbon fluorescence from the relatively weak Raman signals. A current application of such a technique is to the analysis of the mixing and combustion performance of multijet, impinging-jet candidate fuel injectors for the baseline Mars ascent engine, which will burn methane and liquid oxygen produced in-situ on Mars to reduce the propellant mass transported to Mars for future manned Mars missions. The Raman technique takes advantage of the strongly polarized nature of Raman scattering. It is shown to be discernable from unpolarized fluorescence interference by subtracting one polarized image from another. Both of these polarized images are obtained from a single laser pulse by using a polarization-separating calcite rhomb mounted in the imaging spectrograph. A demonstration in a propane-air flame is presented, as well as a high pressure demonstration in the NASA-Marshall Modular Combustion Test Article, using the liquid methane-liquid oxygen propellant system

Author

Rocket Engines; Engine Design; Jet Engine Fuels; Fuel Injection; Liquid Injection

11

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft.

20000083096 Defence Science and Technology Organisation, Melbourne Australia

Hot/Wet Environmental Degradation of Honeycomb Sandwich Structure Representative of F/A-18: Discoloration of Cytec FM-300 Adhesive

Charon, Aaron; May 2000; 32p; In English

Report No.(s): AD-A378758; DSTO-TN-0263; DODA-AR-011-252; Copyright; Avail: Defense Technical Information Center (DTIC)

Bonded honeycomb sandwich panels, consisting of graphite-epoxy face-sheets adhesively bonded to a honeycomb core, are used on military aircraft such as the F/A-18 due to their high stiffness and low weight. Cytec FM-300 is the adhesive extensively used in bonding these composite structures. Water entering these structures can seriously degrade the adhesive bonds between the skin and core and within the core itself. Such degradation poses an issue for structural integrity as shown by a recent study conducted at AMRL. It is often difficult to know whether the internal structure has had prior exposure to water as the structure may dry yet the bonds may be degraded. It has been observed that in some failed components the adhesive changes colour from its original post cure green colour to a light/dark brown. A laboratory experiment was conducted on Cytec FM-300 adhesive to assess the colour change after exposure to a range of hot/wet environments typical of aircraft service. It was found that the adhesive undergoes differing colour changes depending on exposure conditions. The light brown colour seen in some failed components was produced when the relative humidity was greater than 95% and the temperature exceeded 90 deg C for an exposure period in excess of 20 weeks. The study concludes that Cytec FM-300 adhesive that has changed colour to a light or dark brown colour has been directly exposed to a hot/wet environment.

DTIC

Honeycomb Cores; Honeycomb Structures; Sandwich Structures; Graphite-Epoxy Composites; Degradation; Airframes; Moisture

20000094306 NASA Johnson Space Center, Houston, TX USA

Retraction Assembly for Space Shuttle Extended Nose Landing Gear

Files, Bradley S., NASA Johnson Space Center, USA; [2000]; 1p; In English; 3rd; Shape Memory and Superelastic Technologies: Engineering and Biomedical Applications, 30 Apr. - 4 May 2000, Pacific Grove, CA, USA; Sponsored by International Organization on Shape memory and Superelastic Technologies, USA

Contract(s)/Grant(s): RTOP 274-01-97-05; No Copyright; Avail: Issuing Activity; Abstract Only

As part of a project to encourage the use of shape memory alloy actuators for space actuators, this mechanism uses a nitinol ribbon to provide the necessary motion to help retract the proposed extended nose landing gear (ENLG) for the space shuttle. Initial proof-of-concept design of the ENLG did not include the ability to retract the gear automatically. One proposed actuator for this purpose was designed at Johnson Space Center and uses resistive heating to rotate the ribbon around a cylinder. This rotation then allows the assembly to pull down a wedge that is used to hold the landing gear strut in place, thus returning the landing gear to its previous height before extension. The presentation will follow the design of this assembly from working with the nitinol ribbon to providing mechanical connections and allowing minimal friction for motion of three wraps around a cylinder. Also to be presented is preliminary work on design of a shape memory alloy gripper, a design project to demonstrate uses of NiTi.

Author

Actuators; Landing Gear; Nitinol Alloys; Retractable Equipment

12

ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention.

20000089869 North Carolina State Univ., Raleigh, NC USA

Membrane-Mediated Extraction and Biodegradation of VOCs from Air

Peretti, Steven W.; Shepherd, Robert D.; Clayton, Russel K.; Proffitt, David E.; Kaplan, Norman; Mar. 06, 2000; 11p; In English
Report No.(s): AD-A379913; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project is designed to evaluate the feasibility of using a membrane-supported extraction and biotreatment process to meet NESHAP standards for aircraft painting and repainting facilities. The proposed system will both minimize the treated volume and concentrate the VOCs within that treated volume to further reduce the size and cost of the control equipment. These advantages make this VOC treatment option viable over a broad range of spray booth sizes. This will be accomplished using the partitioned recirculation flow reduction technique and a novel VOC concentrating and biological treatment process, the Membrane BioTreatment (MBT) system.

DTIC

Biodegradation; Extraction; Aircraft Maintenance; Air Pollution; Volatile Organic Compounds; Membranes

20000081721 NASA Glenn Research Center, Cleveland, OH USA

A Wideband Satcom Based Avionics Network with CDMA Uplink and TDM Downlink

Agrawal, D., Illinois Univ. at Urbana-Champaign, USA; Johnson, B. S., Illinois Univ. at Urbana-Champaign, USA; Madhow, U., California Univ., USA; Ramchandran, K., California Univ., USA; Chun, K. S., NASA Glenn Research Center, USA; June 2000; 16p; In English; 18th; International Communications Satellite Systems, 10-14 Apr. 2000, Oakland, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG3-2263; RTOP 576-01-21

Report No.(s): NASA/TM-2000-210057; E-12259; NAS 1.15:210057; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this paper is to describe some key technical ideas behind our vision of a future satcom based digital communication network for avionics applications. The key features of our design are as follows: (a) Packetized transmission to permit efficient use of system resources for multimedia traffic; (b) A time division multiplexed (TDM) satellite downlink whose physical layer is designed to operate the satellite link at maximum power efficiency. We show how powerful turbo codes (invented originally for linear modulation) can be used with nonlinear constant envelope modulation, thus permitting the satellite amplifier to operate in a power efficient nonlinear regime; (c) A code division multiple access (CDMA) satellite uplink, which permits efficient access to the satellite from multiple asynchronous users. Closed loop power control is difficult for bursty packetized traffic, especially given the large round trip delay to the satellite. We show how adaptive interference suppression techniques can be used to deal with the ensuing near-far problem; (d) Joint source-channel coding techniques are required both at the physical and the data transport layer to optimize the end-to-end performance. We describe a novel approach to multiple description image encoding at the data transport layer in this paper.

Author

Avionics; Code Division Multiple Access; Time Division Multiplexing

20000091528 Raytheon Training and Services Co., Mesa, AZ USA

Spatial Resolution of Two, High Line-Rate, Monochrome Display Systems *Final Report, Oct. 1998-Oct. 1999*

Geri, George A., Raytheon Training and Services Co., USA; Grutzmacher, Richard P., Raytheon Training and Services Co., USA; Nov. 1999; 9p; In English; Prepared in collaboration with Lockheed-Martin Technology Services, Mesa, AZ.

Contract(s)/Grant(s): F41624-97-D-5000; AF Proj. 1123

Report No.(s): AD-A379453; AFRL-HE-AZ-SR-1999-0008; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This report describes an evaluation of the spatial resolution of two, high line-rate display systems each consisting of the same graphics board but a different monochrome CRT monitor. Given that increasing the line rate of a display does not necessarily increase its spatial resolution, an evaluation of this kind is required to determine the minimum line rate needed to support the training of a given visual task.

DTIC

Display Devices; Cathode Ray Tubes; Flight Simulators

20000081770 NASA Ames Research Center, Moffett Field, CA USA

Attachment-Line Transition Due to Roughness on a 76 Degree Swept Cylinder at Mach 1.6

Coleman, Colin P., NASA Ames Research Center, USA; Poll, D. I. A., Cranfield Univ., UK; [1998]; 30p; In English

Contract(s)/Grant(s): RTOP 519-20-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experiments were conducted on a 76 deg. swept cylinder to establish the conditions for the attachment-line transition process with, and without, surface roughness in a low-disturbance ("quiet"), Mach number 1.6 flow. Local flow parameters were estimated from pressure measurements. These were in good agreement with predictions from an Euler code (CFL3D) and a boundary layer code (BL3D). Hot-wires and Schlieren photography were used to determine the state of the boundary layer. It was found that, for a near-adiabatic wall condition and a smooth surface, the attachment-line, boundary-layer remained laminar up to the highest

attainable Reynolds number (R -bar of 790). Transition under the influence of trip wires was found to depend on wind-tunnel disturbance levels and the onset conditions have been established. Results suggest that current design practice, which is based upon data from conventional ("noisy") tunnels, may be highly conservative.

Author

Supersonic Boundary Layers; Flow Characteristics; Supersonic Speed; Surface Roughness; Wind Tunnel Tests; Boundary Layer Separation; Flow Visualization; Pressure Measurement; Boundary Layer Transition; Reynolds Number; Wind Tunnel Models; Cylindrical Bodies; Swept Wings

20000088561 NASA Langley Research Center, Hampton, VA USA

A 3-D Coupled CFD-DSMC Solution Method With Application to the Mars Sample Return Orbiter

Glass, Christopher E., NASA Langley Research Center, USA; Gnoffo, Peter A., NASA Langley Research Center, USA; July 2000; 24p; In English; 22nd; 22nd International Symposium on Rarefied Gas Dynamics, July 2000, Sydney, Australia

Contract(s)/Grant(s): RTOP 242-80-01-01

Report No.(s): NASA/TM-2000-210322; NAS 1.15:210322; L-18012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method to obtain coupled Computational Fluid Dynamics-Direct Simulation Monte Carlo (CFD-DSMC), 3-D flow field solutions for highly blunt bodies at low incidence is presented and applied to one concept of the Mars Sample Return Orbiter vehicle as a demonstration of the technique. CFD is used to solve the high-density blunt forebody flow defining an inflow boundary condition for a DSMC solution of the afterbody wake flow. by combining the two techniques in flow regions where most applicable, the entire mixed flow field is modeled in an appropriate manner.

Author

Computational Fluid Dynamics; Monte Carlo Method; Three Dimensional Flow; Direct Numerical Simulation; Mars Sample Return Missions; Aerodynamic Configurations

20000088671 Academy of Sciences (USSR), Inst. of Atmospheric Optics, Tomsk, USSR

Characterization of Aircraft-Induced Atmospheric Aberrations *Final Report*

Zemlyanov, Alexander; Lukin, Vladimir; Jan. 2000; 93p; In English

Contract(s)/Grant(s): F61775-99-W-E022

Report No.(s): AD-A379018; EOARD-SPC-99-4035; No Copyright; Avail: Defense Technical Information Center (DTIC)

The first year stage of program of the investigations includes the work with references, development of experimental set up, creation of necessary devices, and experiments at Tomsk airport. It is well known that data obtained from measurements of turbulence intensity, wind velocity profiles, and temperature at the altitudes of 10-15 km signify the zones of sharp changes near the tropopause. In this context it is essential to distinguish the foot print of the aircraft from characteristic of nondisturbed turbulence. So the work with references are still continue in the following directions: atmospheric characteristic at altitudes of 10 - 15 km; turbulence characteristic at altitudes of 10 - 15 km; characteristic of aircraft engines, especially for B-747 and IL-86 planes, at altitudes of 10 - 15 km; characteristic of aircraft foot prints under conditions of real flight. and direct measurements of turbulence and refraction are performing in a plane foot print at the ground level. We are assuming to construct the model of atmospheric turbulence on the high elevated paths along the long distance propagation.

DTIC

Atmospheric Turbulence; Laminar Flow; Plumes; Exhaust Emission; Contrails; Aircraft Engines; Vortices

20000088575 Army Aeromedical Research Lab., Fort Rucker, AL USA

Feasibility of Using the AN/PVS-14 Monocular Night Vision Device for Pilotage *Final Report*

McLean, William e.; Estrada, Arthur; Jun. 2000; 49p; In English

Report No.(s): AD-A379764; USAARL-2000-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The AN/PVS-14 Monocular Night Vision Device (MNVD) high performance image intensification system was designed for ground use. During a USAARL optical and visual evaluation of the MNVD, the authors noted that the user could fuse the intensified image with the unaided or nondisplay viewing eye. The fused images from the right and left eyes provided some color and depth perception under certain night lighting conditions and allowed the unaided eye to remain dark adapted. This assessment explored the potential use of the MNVD for pilotage using two experienced night vision goggle (NVG) UH-60 pilots and two experienced AH-64 pilots, who also used the helmet display unit (HDU) with symbology and thermal imagery.

DTIC

Goggles; Image Intensifiers; Night Vision; Feasibility; Aircraft Pilots; Monocular Vision

20000085552 NASA Goddard Space Flight Center, Greenbelt, MD USA

Photon-Counting Microlaser Rangers, Transponders, and Altimeters

Degnan, John J., NASA Goddard Space Flight Center, USA; [2000]; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unlike current manned systems, NASA's next generation SLR2000 Satellite Laser Ranging (SLR) station is fully autonomous. eye-safe, relatively compact and inexpensive. and, during daytime tracking operates at signal-to-noise ratios several orders of magnitude below unity. Tiny, passively Q-switched microlasers generate ultra-short pulses with output energies on the order of 100 micron-J at few kHz rates to achieve mm-level ranging precision to satellite altitudes of 20,000 km. Special ranging receivers, combined with Poisson statistical analysis of the received photon distribution, enable the system to rapidly and reliably identify and extract the single photon laser echoes from the solar background. The enhanced rate of return, combined with a uniform signal strength, can actually drive down both systematic and random range errors. The new SLR2000 technology has already spawned exciting new applications. Compact microlaser altimeters, capable of mapping the surface of a planet or other celestial body at multikilohertz rates, is one such application, and a high altitude, airborne version is currently being developed under NASA's Instrument Incubator Program. Interplanetary microlaser transponders would be capable of performing decimeter ranging or subnanosecond time transfer to spacecraft throughout the inner Solar System. resulting in improved knowledge of planetary motions and liberations and enhanced General Relativity experiments.

Author

Photons; Countermeasures; Altimeters; Statistical Analysis; Signal to Noise Ratios; Satellite Instruments; Rangefinding; Man Machine Systems; Laser Range Finders

20000083962 NASA Glenn Research Center, Cleveland, OH USA

Rudder/Fin Seal Investigations for the X-38 Re-Entry Vehicle

Dunlap, Patrick H., Jr., NASA Glenn Research Center, USA; Steinetz, Bruce M., NASA Glenn Research Center, USA; Curry, Donald M., NASA Johnson Space Center, USA; July 2000; 22p; In English; 36th; 36th Joint Propulsion Conference and Exhibit, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 505-23-OU

Report No.(s): NASA/TM-2000-210338; NAS 1.15:210338; E-12384; AIAA Paper 2000-3508; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA is currently developing the X-38 vehicle that will be used to demonstrate the technologies required for a crew return vehicle (CRV) for the International Space Station. The X-38 control surfaces require high temperature seals to limit hot gas ingestion and transfer of heat to underlying low-temperature structures to prevent over-temperature of these structures and possible loss of the vehicle. This paper presents results for thermal analyses and flow and compression tests conducted on as-received and thermally exposed seals for the rudder/fin location of the X-38. A thermal analysis of the rudder/fin dual seal assembly based on representative heating rates on the windward surface of the rudder/fin area predicted a peak seal temperature of 1900 F. The temperature-exposed seals were heated in a compressed state at 1900 F corresponding to the predicted peak temperature. Room temperature compression tests were performed to determine load versus linear compression, preload, contact area, stiffness, and resiliency characteristics for the as-received and temperature-exposed seals. Temperature exposure resulted in permanent set and loss of resiliency in these seals. Unit loads and contact pressures for the seals were below the 5 lb/in. and 10 psi limits set to limit the loads on the Shuttle thermal tiles that the seals seal against in the rudder/fin location. Measured seal flow rates for a double seal were about 4.5 times higher than the preliminary seal flow goal. The seal designs examined in this study are expected to be able to endure the high temperatures that they will be exposed to for a single-use life. Tests performed herein combined with future analyses, arc jet tests, and scrubbing tests will be used to select the final seal design for this application.

Author

X-38 Crew Return Vehicle; Rudders; Fins; Seals (Stoppers); Reentry Vehicles; High Temperature Tests; Thermal Analysis; Reentry Shielding; Performance Tests

20000089698 Seoul National Univ., School of Mechanical and Aerospace Engineering, Korea, Republic of

Iterative Control-Relevant Identification and Controller Enhancement of a MIMO Magnetic Bearing System

Han, Dong-Chul, Seoul National Univ., Korea, Republic of; Lee, Sang-Wook, Seoul National Univ., Korea, Republic of; Ahn, Hyeong-Joon, Seoul National Univ., Korea, Republic of; Lee, Sang-Ho, Seoul National Univ., Korea, Republic of; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 155-167; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The magnetic bearing systems are intrinsically unstable and need the feedback control of electromagnetic forces with measured displacements. So the controller design plays an important role in constructing high performance magnetic bearing system. In case of magnetic bearing systems, the order of identified model can be high because of unknown dynamics included in closed loop systems - such as sensor dynamics, actuator dynamics - and non-linearity of magnetic bearings. "Identification for control" - joint optimization of system identification and controller design - is proposed to get the limited-order model which is suited for the design of high-performance controller. We applied the Joint identification/controller design scheme to MIMO rigid rotor system supported by magnetic bearings. First, we designed controller of a nonlinear simulation model of MIMO magnetic bearing system with this scheme and proved its feasibility. Then, we performed experiments on MIMO rigid rotor system supported by magnetic bearings, and the results shows that the performance of the closed-loop system is gradually improved during the iteration.

Derived from text

Control Systems Design; Magnetic Bearings; MIMO (Control Systems); Rigid Rotors; Mathematical Models; Iteration

20000089712 National Defense Academy, Dept. of Mechanical Engineering, Japan

Vibration Control on Active Magnetic Bearing Equipped Flywheel Rotor

Katsuno, Keiji, National Defense Academy, Japan; Okubo, Hiroki, National Defense Academy, Japan; Fujiwara, Hiroyuki, National Defense Academy, Japan; Matsushita, Osami, National Defense Academy, Japan; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 327-338; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Flywheel technology has been developing for an effective and clean means of energy storage techniques. From the point of view of the improvement for the stable rotation during high speed revolution, we employed the active magnetic bearing (AMB) to apply it to a flywheel test rotor. Our AMB equipped flywheel rotor is levitated without mechanical contact by five-axis controllers in the decentralized manner: three positions to vertically suspend this flat rotor and two X and Y rotations to maintain the rotor at a neutral position. In this paper, we propose several ideas in numerical simulations concerning the AMB control method for the stability improvement of this flywheel rotor. An equivalent reduced model of the rotor is first completed from the quasi-modal method. The traditional PID control is mainly applied to the standstill levitation. This PID controller is not able to cover the stability in the entire speed range, because natural frequencies split into two ways due to the strong gyroscopic effect: the increase of the forward eigenfrequency and the decrease of the backward eigenfrequency. In order to compensate the destabilization caused by this split, we recommend the addition of an optional technique of the cross stiffness control. The simulation proves that the cross stiffness control should be combined with a band-pass filter for selecting the forward eigenmode vibration and a low pass filter for tuning the backward mode vibration. We also consider the spillover instability due to the flexibility of the flywheel disk.

Author

Flywheels; Magnetic Bearings; Rotors; Vibration Damping; Control Systems Design; Control Stability

20000089715 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan

Identification and Control of Unbalance and Sensor Runout on Rigid by Active Magnetic Bearing Systems

Kanemitsu, Yoichi, Kyushu Univ., Japan; Kijimoto, Sinya, Kyushu Univ., Japan; Matsuda, Koichi, Kyushu Univ., Japan; Jin, Park Tea, Kyushu Univ., Japan; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 367-381; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In this paper, we propose a new identification method of the sensor runout and the unbalance on a rigid rotor supported by active magnetic bearings applying the incremental least square on-line method and perform some numerical simulations and experiments on the their identification applying to a rigid rotor model of a turbo-molecular pump. The paper also presents some results of the experiment on the identification accuracy and effects of the rotor model error. From the numerical simulations and the experiments, we conclude that the proposed identification method is effective for the simultaneous identification of the unbalance of rotor and the sensor runout.

Author

Magnetic Bearings; Molecular Pumps; Rigid Rotors; Turbine Pumps; Active Control; Sensors; Mathematical Models

20000089718 Wien Univ., Inst. for Machine Dynamics and Measurements, Austria

Nonlinear Stability Analysis of Active Magnetic Bearings

Steinschaden, Norbert, Wien Univ., Austria; Springer, Helmut, Wien Univ., Austria; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 411-427; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In order to get a better understanding of the dynamics of active magnetic bearing (AMB) systems under extreme operating conditions a nonlinear model for a radial AMB system is investigated. Instead of the common way of linearizing the magnetic forces at the center position of the rotor with respect to rotor displacement and coil current, the fully nonlinear force to displacement and force to current characteristics are used. The nonlinear model employed in this investigation is an advanced version of a simple nonlinear model, which has already been published and discussed. Magnetic saturation effects, saturation of the amplifier and limitations of the control currents are additional nonlinear components modeled in this work. The AMB system is excited by unbalance forces of the rotor. Especially for the case of large rotor eccentricities, causing large rotor displacements, the behaviour of the system is discussed. A path-following analysis of the equations of motion shows that for some combinations of parameters well-known nonlinear phenomena may occur.

Author

Magnetic Bearings; Nonlinearity; Stability Tests; Mathematical Models; Rotors

20000089720 Virginia Univ., Mechanical and Aerospace Engineering, Charlottesville, VA USA

Real Time Control of a Magnetic Bearing Suspension System for Flexible Rotors

Hilton, Edgar F., Virginia Univ., USA; Humphrey, Marty, Virginia Univ., USA; Stankovic, John, Virginia Univ., USA; Allaire, Paul, Virginia Univ., USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 443-457; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Suspension of a magnetic bearing system involves significant computational effort. Control systems based upon embedded Digital Signal Processors (DSP) boards often require specialized programming and development tools, may lack flexibility when computational requirements change, and are often relatively expensive. Magnetic bearing systems need 1) real time monitoring of the plant states, inputs, and outputs 2) real time plotting functions such as rotor position vs. time, Fast Fourier Transform (FFT) functions and user specified filters, 3) controller parameter updates, and 4) access to reference signals. It is desired to employ a hardware/software system which is low cost, easy to use, is extensible as more advanced versions of hardware/software become available, and distributable over local networks of DSPs. A system with all of the above desired characteristics has been implemented for control of a magnetic bearing supported flexible rotor using RT-Linux, a free modification of Linux, intended to support hard real-time computation. Experiences designing the software architecture, defining timing requirements of the control tasks, implementing the control tasks in RT-Linux, and measuring the predictability of RT-Linux for this application are discussed.

Author

Flexibility; Magnetic Bearings; Real Time Operation; Rotors; Magnetic Suspension; Control Systems Design; Computer Programming

20000081677 Boeing Co., Military Aircraft and Missile Systems, Saint Louis, MO USA

Mobile Automated Scanner System (MAUS) Final Report, 1 Oct. 1991 - 15 Apr. 1999

Palmer, Donald D., Jr.; Wood, Nancy L.; Apr. 1999; 147p; In English

Contract(s)/Grant(s): F33615-91-C-5664; AF Proj. 3153

Report No.(s): AD-A366930; AFRL-ML-WP-TR-1999-4104; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

This report describes the full scale development of a portable, multi-modal, large area scanning system for nondestructive inspection of airframe structures. The Mobile Automated Scanner (US) incorporated ultrasonic pulse echo, ultrasonic resonance and eddy current scanning capabilities with scan speeds up to 400 sq. ft./hr. The system generates C-scan formatted data for interpretation and archiving. Prototype systems were deployed at five Air Logistics Centers and two Navy depots for evaluation. The system was subsequently productionized as the MAUS IV.

DTIC

Scanners; Aircraft Structures

20000086222 NASA Glenn Research Center, Cleveland, OH USA

Cascade Optimization for Aircraft Engines With Regression and Neural Network Analysis - Approximators

Patnaik, Surya N., Ohio Aerospace Inst., USA; Guptill, James D., NASA Glenn Research Center, USA; Hopkins, Dale A., NASA Glenn Research Center, USA; Lavelle, Thomas M., NASA Glenn Research Center, USA; July 2000; 24p; In English

Contract(s)/Grant(s): RTOP 523-24-13

Report No.(s): NASA/TM-2000-209177; E-11686; NAS 1.15:209177; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Engine Performance Program (NEPP) can configure and analyze almost any type of gas turbine engine that can be generated through the interconnection of a set of standard physical components. In addition, the code can optimize engine

performance by changing adjustable variables under a set of constraints. However, for engine cycle problems at certain operating points, the NEPP code can encounter difficulties: nonconvergence in the currently implemented Powell's optimization algorithm and deficiencies in the Newton-Raphson solver during engine balancing. A project was undertaken to correct these deficiencies. Nonconvergence was avoided through a cascade optimization strategy, and deficiencies associated with engine balancing were eliminated through neural network and linear regression methods. An approximation-interspersed cascade strategy was used to optimize the engine's operation over its flight envelope. Replacement of Powell's algorithm by the cascade strategy improved the optimization segment of the NEPP code. The performance of the linear regression and neural network methods as alternative engine analyzers was found to be satisfactory. This report considers two examples-a supersonic mixed-flow turbofan engine and a subsonic waverotor-topped engine-to illustrate the results, and it discusses insights gained from the improved version of the NEPP code.

Derived from text

Aircraft Engines; Neural Nets; Regression Analysis; Optimization; Cascade Control; Aircraft Performance

20000093957 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia

Microgrid Plastic Strain Analysis of a Representative F-111C Fuel Flow Vent Hole 13 Coupon

Kowal, E., Defence Science and Technology Organisation, Australia; Heller, M., Defence Science and Technology Organisation, Australia; March 2000; 56p; In English

Report No.(s): DSTO-TR-0951; AR-011-236; Copyright; Avail: Issuing Activity

This report presents results for the application and associated improvement of an AED microgridding procedure for the determination of highly localised strains. The procedure has been applied to determine plastic strains at the critical location for a plate with a reworked FFFVH13 geometry, subjected to F-111C CPLT loading. by using multiple measurements over an increased gauge length of 150 microns, highly accurate strains, ranging in accuracy between 57 and 135 micro strain were determined. This accuracy level is approximately an order of magnitude better than the prior microgridding approach. For the critical region, detailed non-linear strain hysteresis responses were obtained, and the measured peak and residual strains of -2.16024% strain and -0.79349% strain respectively agreed well with prior finite element predictions. The measured residual compressive strains at the critical location indicate that there is a significant residual tensile stress, which is consistent with the known occurrence of fatigue cracking in the fleet. This investigation has also provided valuable strain data for use in validating advanced FE based constitutive models, which are currently used and under development in AED for obtaining airframe structural integrity assessments.

Author

Structural Stability; Residual Stress; Mathematical Models; Airframes; Accuracy; Computational Grids

13

GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology.

20000080353 Risoe National Lab., Wind Energy and Atmospheric Physics Dept., Roskilde, Denmark

Double stall

Bak, C.; Aagaard Madsen, H.; Fuglsang, P.; Rasmussen, F.; Jun. 30, 1998; 34p; In English

Report No.(s): DE99-717257; RISO-R-1043(EN); ISBN 87-550-2379-7; No Copyright; Avail: Department of Energy Information Bridge

The double stall phenomenon for airfoil flows is characterized by at least two distinct stall levels to identical inflow conditions. In this work, a likely explanation of double stall was found. Observations on full-scale rotors, in wind tunnel experiments, and in computational fluid dynamic (CFD) calculations could show at least two different distinct lift levels to identical inflow conditions in stall. The CFD calculations revealed a generation of a little laminar separation bubble at the leading edge of the airfoil for incidences near maximum lift. The bursting of this bubble could explain the sudden shift in lift levels. This investigation indicated that bursting would appear if the maximum position of the free transition point was close to the minimum position of the transition point causing leading-edge stall. Thus, the investigation indicated that double stall could be predicted from CFD calculations and that double stall therefore could be avoided in design of new airfoils.

NTIS

Computational Fluid Dynamics; Aerodynamic Stalling

20000085610 NEG Micon A/S, Randers, Denmark

Technical description of the NTK1500/60-60

Soendergaard, H.; Jul. 31, 1997; 54p; In English

Report No.(s): DE99-730833; NEI-DK-3368; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The 1.5 MW turbine is a tree blade upwind rotor with a hub height of 60 m. The tube tower has a diameter of 3.8 m in top and 4.2 m at the base and is the world largest commercial three blade stall regulated wind turbine. The development project is subsidized by EU under the THERMIE and JOULE II programs for demonstration for research respective development. The design process resulted in a smoothly formed nacelle placed on a double coned tower which 'firmly holds' on to the nacelle. The overall design was finished in August 1994 and the turbine was erected in late August 1995 and set into commissioning in September 1995. The measuring program was started in September 1995 and will be completed in December 1997.

NTIS

Rotors; Wind Turbines; Design Analysis; Turbine Blades

20000089871 Naval Postgraduate School, Monterey, CA USA

Optimization of MAS and MODIS Polar Ocean Cloud Mask

Memmen, Sean P.; Jun. 2000; 96p; In English

Report No.(s): AD-A379940; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

With the reduction of funding for sea ice reconnaissance flights, the National/Naval Ice Center needs to capitalize on the improvements in satellite technology. Imaging sensors such as Advanced Very High Resolution Radiometer (AVHRR), Defense Meteorological Satellite Program/Optical Line Scanner (DMSP/OLS), Special Sensor Microwave Imager (SSM/I) and Radar Satellite (RADARSAT) have been used to detect the presence of sea ice, but with the exception of SSM/I and RADARSAT, clouds are a major obstacle to viewing the surface. With NASA's development of the Moderate-resolution Imaging Spectroradiometer (MODIS) and MODIS Airborne Simulator (MAS), there is finally a sensor capable of using multi-spectral techniques to detect the presence of clouds. A group at the Space Science and Engineering Center (SSEC), University of Wisconsin - Madison lead by Dr. Steve Ackerman has developed a mask for MAS/MODIS. The technique determines a level of confidence that a given pixel is clear based on a series of multi-spectral tests. By combining the confidence level from all tests, it is possible to detect the presence of clouds at different altitudes in the atmosphere. Based on the Ackerman et al. (1997) scheme, threshold optimizations were made on the T(beta)(11 micrometers) and T(beta)(3.9 micrometers) - T(beta)(11 micrometers) tests, while the T(beta)(11 micrometers) - T(beta)(12 micrometers) test was removed. These are daytime modifications based on analysis of several MAS and a limited number of MODIS cases. From subjective analysis, the modifications greatly improved the detection of clouds over cold polar oceans where sub-pixel ice may be present or water temperatures might falsely indicate clouds. The number of Cloudy pixels (less than 0.66 clear confidence level) for a given scene was increased 12.1% on average for MAS cases. The NPS cloud mask also classified two times more Probably Clear and Undecided pixels than the original mask due to eater sensitivity to thin, small clouds.

DTIC

Imaging Spectrometers; Optimization; Spectroradiometers; Oceans; Flight Simulators; Remote Sensing; Polar Regions; Clouds (Meteorology)

20000083349 NASA Wallops Flight Facility, Wallops Island, VA USA

Measured Correlation Between Roll-Vortex Signatures and Radar-Inferred Sea Surface Roughness

Vandemark, Douglas, NASA Wallops Flight Facility, USA; Mourad, Pierre, Washington Univ., USA; Crawford, Tim, National Oceanic and Atmospheric Administration, USA; Vogel, Chris, National Oceanic and Atmospheric Administration, USA; [2000]; 1p; In English; IGARSS 1999, 29 Jun. - 2 Jul. 1999, Hamburg, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents aircraft measurements of near-surface atmospheric boundary layer roll signatures and radar-derived sea surface roughness. These data are completely coincident in space and time and this unique feature supports attempts to definitively link SAR backscatter signatures to boundary layer roll impacts. The open-ocean data were collected at an altitude of 20 in from NOAA's Long-EZ aircraft using its turbulence probe and down-looking Ka-band radar scatterometer. Several flight legs of 20-30 km were flown with a heading across the wind direction, which is also roughly perpendicular to the roll vortices. We find remarkable correlation between measured modulations in the along-wind component of wind speed and radar backscatter for the spatial scale of 1 to 1.5 km. Close agreement between normalized modulation amplitudes suggests the radar-inferred surface slope variance is changing linearly with wind speed. These data were collected within 30 minutes of a RADARSAT SAR overpass where apparent boundary layer impacts of the same orientation and spatial dimension are prevalent in the SAR backscatter image. Quantitative comparison between modulations in the aircraft and satellite radar data will be discussed.

Author

Aircraft Instruments; Measuring Instruments; Ocean Surface; Sea Roughness; Wind Velocity; Atmospheric Boundary Layer

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions.

20000083953 Institute of Space Medico-Engineering, Beijing, China

Relation to GFR and Endothelin in the Plasma in Pilots and Ground Crew

Dai, Yu, Institute of Space Medico-Engineering, China; Dai, Da-Jiang, Institute of Space Medico-Engineering, China; Ji, Guiying, Institute of Space Medico-Engineering, China; Ren, Qu, Institute of Space Medico-Engineering, China; Wang, Xue-Juan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 143-145; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To observe the specific property of Glomerular Filtration Rate (GFR) and its relation to endothelin of plasma in pilots. GFR was assessed with single photon emission computed tomography (SPECT), tracer for ^{99m}Tc -DTPA, endothelin of plasma were measured by radio immunoassay in forty-six pilots, thirty ground crew and renal disease patients. Endothelin were not correlation with GFR in pilots. GFR of pilots and ground crew had not a significant difference. Compared with ground crew and pilots, endothelin of renal disease patients had a significant increased, and GFR had a significant decreased. Age were a linear negative correlation with total GFR $r = (0.84, P \text{ less than } 0.01)$, flying time, age had not correlation with endothelin. After thirty-one ground endothelin had a significant difference with ground crew. It suggested that the endothelin has no influence on GFR in pilots when it was increased with in the limits of a level, pilots and ground crew may use the same stand on GFR.

Author

Filtration; Plasmas (Physics); Glomerulus; Endothelium; Aircraft Pilots; Ground Crews; Aerospace Medicine

20000094005 Civil Aeromedical Inst., Oklahoma City, OK USA

Refractive Surgery in Aircrew Members Who Fly for Scheduled and Nonscheduled Civilian Airlines *Final Report*

Nakagawara, Van B., Civil Aeromedical Inst., USA; Wood, Kathryn J., Civil Aeromedical Inst., USA; Montgomery, Ronald W., Civil Aeromedical Inst., USA; May 2000; 14p; In English

Contract(s)/Grant(s): AM-A-99-TOX-203

Report No.(s): DOT/FAA/AM-00/19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Civil airmen with refractive surgery are present in all classes of aeromedical certificate holders. Refractive surgical procedures have been associated with numerous side effects, including glare, reduced contrast sensitivity, and fluctuating visual acuity. These side effects may render the quality of vision unacceptable in the cockpit environment. This study reviews the aeromedical certification experience with refractive surgery in aircrew members who fly for civilian airlines. Methods. Active airmen with FAA-specific pathology codes 130 (radial keratotomy) and 5179 (general eye pathology with surgical prefix) in the Consolidated Airman Information System medical database during the period 1 January 1994 through 31 December 1996 were identified. Airmen were stratified into those with a first-class medical certificate, an occupational code 1 (pilot, copilot, first, and second officer) or code 2 (flight engineer), and an employer code of a scheduled or nonscheduled airline. The medical records of these airmen were reviewed, and the clinical data were collated and analyzed. Results. A total of 133 flight crewmembers (125 pilots and 8 flight engineers) were identified as employees of airlines and having had refractive surgery. Seventeen airmen (12.8%) were miscoded and 2 airmen (1.5%) were lost to follow-up. of the 114 pilots with refractive surgery, 97 (85.1 %) were incisional procedures, 15 (13.2%) were laser procedures, and 2 (1.7%) were complex surgical procedures. Three airmen (2.6%) had serious complications resulting from the refractive procedure, including postoperative stromal haze, depth perception problems, and a perforated cornea and crystalline lens resulting in a cataract. Conclusions. The preponderance of aircrew members who have had refractive surgery and fly for scheduled or nonscheduled airlines have incisional refractive procedures, which reportedly have the most critical visual side effects. A considerable number of airmen have had laser procedures, of which the long-term effects are still unknown. Although some serious complications have resulted from refractive surgery, the study indicates these complications have not affected an applicant's ability to receive an airman medical certificate.

Author

Aerospace Medicine; Aircraft Pilots; Cataracts; Cornea; Eye (Anatomy); Visual Acuity

20000089927 Air Force Research Lab., Human Effectiveness Directorate, Mesa, AZ USA

Unmanned Aerial Vehicle Operator Qualifications, Jan. 1999 - Jan. 2000

Weeks, Joseph L.; Mar. 2000; 20p; In English

Contract(s)/Grant(s): AF Proj. 2313

Report No.(s): AD-A379424; AFRL-HE-AZ-TR-2000-0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There are large differences in operator qualifications for unmanned aerial vehicles (UAVs) operated by the Department of Defense. These differences were examined to identify underlying causes. For tactical UAVs operated by the US Navy, Marine Corps, and Army, specially trained enlisted personnel may qualify as internal pilot. Flight experience in manned aircraft is not required. For the medium-altitude endurance UAV employed by the USAF, only officers who are pilots of manned aircraft or navigators holding a commercial pilot's license with an instrument rating may qualify as internal pilot. The interaction of UAV flight capabilities and federal aviation guidelines underlie these differences. Although service policy and federal aviation guidelines determine operator qualifications, research into the essential skills of UAV operators is needed. Knowledge of essential skills would guide design of training and identify human performance issues associated with mission execution. Knowledge of essential skills will serve as the frame of reference for research into the performance effects of mission length, night-time operations, and circadian dysrhythmia. Development of remedial training and cueing technologies could follow as strategies for minimizing adverse effects on mission performance.

DTIC

Qualifications; Unmanned Spacecraft; Operators (Personnel); Flight Characteristics; Dast Program

20000092064 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Kingdom in the Sky - Earthly Fetters and Heavenly Freedoms. The Pilot's Approach to the Military Flight Environment
le Royaume au Ciel - Fers Terrestres et Libertes Celestes. La Demarche du Pilote vis a vis de l'Environnement Aeronautique Operationnel

Ponomarenko, V., Research and Technology Organization, France; Boubel, T., Editor, Research and Technology Organization, France; Ercoline, W., Editor, Research and Technology Organization, France; July 2000; 162p; In English; CD-ROM contains full text document in PDF format; Translator: I. Malinin

Report No.(s): RTO-AG-338; AC/323[HFM]TP/5; ISBN 92-837-1041-X; Copyright Waived; Avail: CASI; A08, Hardcopy; C01, CD-ROM

This book provides insight from a Russian perspective into the psychology of the flyers (pilot and other aircrew members), and their constant struggle to cope with the procedures dictated by ground-based directors while enjoying the thrill and emotional high of flight. The author takes the reader through the turmoil of flight emergencies, unpopular ground-directed missions, and, ultimately, aircraft mishaps. He describes the difficult conditions placed upon the flyers by a system inadequately prepared to address human factor issues, and points out that it is the responsibility of those on the ground to improve the conditions of the flyer. Those improvements can come from knowledge based on research and appreciation of the flyers' mission. Chapter 1 provides details of the problems associated with aircraft accident investigations and the impact these can have on the flyer's dignity. Chapter 2 describes many of the dangers associated with flight, as well as the skills necessary to overcome those hazards. Chapter 3 describes the current state of human factor issues and flight safety. Chapter 4 deals with ergonomics and their relationship with flight safety. Chapter 5 matches the role of the flight surgeon with the operational requirements of the flyers. Chapter 6 identifies the problems encountered when one is too conservative toward a profession that requires radical, rapid, and sometimes fatal in flight decisions. Chapter 7 explains how the flyer can maintain a healthy body and mind. Chapter 8 summarizes the research and lessons learned by the author while working with the flyer and within the establishment.

Author

Aircraft Accident Investigation; Flight Safety; Flight Crews; Aviation Psychology; Aircraft Accidents; Pilot Training; Russian Federation; Histories

20000093972 Naval Postgraduate School, Monterey, CA USA

Human Factors Analysis of Fiscal Year 90 to 97 Rotary Wing and TACAIR Flight Mishaps

Denham, Kenneth R.; Jun. 2000; 116p; In English

Report No.(s): AD-A379445; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Human error is present in approximately 60 to 80 percent of all Naval Aviation (NA) flight mishaps (FMs). This indicates a need to identify the patterns and relationships of human error associated with NA FMs in order to develop tailored intervention strategies. This study uses the Human Factors Analysis and Classification System (HFACS), a human error oriented accident Investigation and analysis process, to conduct post-hoc analysis of 77 rotary wing and 141 Tactical Aircraft (TACAIR) Class A and B human error FMs from Fiscal Year 90 to 97. This study indicates that Skill-Based Error, Decision Error, Adverse Mental State (AMS) and Crew Resource Management (CRM) are the predominant human error types associated with NA FMs. A nonparametric bootstrap simulation is performed for singular and combinations of human error types to develop the most effective intervention strategies. For the rotary wing community, the CRM human error type represents the best target for selected intervention strategies and potential cost savings. The AMS human error type provides the best target for selected intervention

strategies and potential cost savings for the TACAIR community. The use of flight simulators is viewed as the most effective intervention strategy for both predominant human error types identified.

DTIC

Human Factors Engineering; Error Analysis; Aircraft Accidents; Rotary Wings; Accident Investigation

15

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science.

20000082016 NASA Glenn Research Center, Cleveland, OH USA

NPSS on NASA's Information Power Grid: Using CORBA and Globus to Coordinate Multidisciplinary Aerospace Applications

Lopez, Isaac, Army Research Lab., USA; Follen, Gregory J., NASA Glenn Research Center, USA; Gutierrez, Richard, Integral Systems, Inc., USA; Foster, Ian, Argonne National Lab., USA; Ginsburg, Brian, Argonne National Lab., USA; Larsson, Olle, Argonne National Lab., USA; Martin, Stuart, Argonne National Lab., USA; Tuecke, Steven, Argonne National Lab., USA; Woodford, David, Argonne National Lab., USA; July 2000; 14p; In English; Computational Aerosciences Workshop, 15-17 Feb. 2000, Moffett Field, CA, USA; Sponsored by NASA Glenn Research Center, USA

Contract(s)/Grant(s): W-31-109-eng-38; RTOP 509-10-24

Report No.(s): NASA/TM-2000-209956; NAS 1.15:209956; E-12212; ARL-TR-2262; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a project to evaluate the feasibility of combining Grid and Numerical Propulsion System Simulation (NPSS) technologies, with a view to leveraging the numerous advantages of commodity technologies in a high-performance Grid environment. A team from the NASA Glenn Research Center and Argonne National Laboratory has been studying three problems: a desktop-controlled parameter study using Excel (Microsoft Corporation); a multicomponent application using ADPAC, NPSS, and a controller program-, and an aviation safety application running about 100 jobs in near real time. The team has successfully demonstrated (1) a Common-Object- Request-Broker-Architecture- (CORBA-) to-Globus resource manager gateway that allows CORBA remote procedure calls to be used to control the submission and execution of programs on workstations and massively parallel computers, (2) a gateway from the CORBA Trader service to the Grid information service, and (3) a preliminary integration of CORBA and Grid security mechanisms. We have applied these technologies to two applications related to NPSS, namely a parameter study and a multicomponent simulation.

Author

Applications Programs (Computers); Computerized Simulation; Propulsion; Distributed Processing; Parallel Processing (Computers); Real Time Operation; Aircraft Engines; Software Engineering; Multidisciplinary Design Optimization

20000089738 Bath Univ., Dept. of Mechanical Engineering, Bath, UK

Neural Network Based Fault Detection for Fault Tolerant Control of Systems with Multiple Magnetic Actuators and Sensors

Cole, Matthew O. T., Bath Univ., UK; Keogh, Patrick S., Bath Univ., UK; Burrows, Clifford R., Bath Univ., UK; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 689-703; In English; See also 20000089691; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

There is considerable interest in the improvement of fault tolerance in the design of active position and vibration control systems. In the creation of many magnetic actuator position or vibration control systems there exists potential for the inclusion of redundancy in the number of actuators and sensors used for control. This redundancy can provide improved tolerance to actuator or sensor related faults if, when a fault occurs, control of the system can be rapidly reconfigured to bypass control from a faulty component to the remaining healthy ones. to do this requires a system for the detection and identification of faults as and when they occur. The performance of modern computerized control hardware is now sufficient to allow such a system to run in real-time, in parallel to any digital control algorithm. In this paper the development of a method for the detection and isolation of faults relating to control sensors and actuators is presented as a basis for the implementation of a fault tolerant control scheme. The method is based on the use of a neural network, operating in real time, for the detection of signal errors occurring in the plant inputs or outputs. The neural network is trained off-line using identification data taken from the plant and therefore does not require an accurate model of the plant dynamics. Results are presented for the application of this method to an active magnetic bearing/rotor system, both in simulation and experiment. The issues of sensitivity to faults, speed of response and the effect of external disturbances on the reliability of the fault detection system are investigated and discussed. It is demonstrated that, through the

implementation of a reconfigurable control scheme with a fault detection system, improved tolerance to sensor and actuator related faults can be achieved.

Derived from text

Actuators; Fault Detection; Fault Tolerance; Magnetic Bearings; Neural Nets; Rotors; Active Control; Sensors

20000094218 Colorado Univ., Boulder, CO USA

Mars Aerial Research Vehicle: MARV

Mottinger, Ben, Colorado Univ., USA; Wicklund, Dan, Colorado Univ., USA; Muckenthaler, Jason, Colorado Univ., USA; Young, Corissa, Colorado Univ., USA; Graham, Colin, Colorado Univ., USA; Schell, Eric, Colorado Univ., USA; Kutumbos, Ted, Colorado Univ., USA; Third Annual HEDS-UP Forum; 2000, pp. 57-76; In English; See also 20000094214; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Mars Aerial Research Vehicle (MARV) is based on the NASA Langley mission Mars Airplane Package (MAP). The deployment sequence of the MAP was designed, as well as the method of separation from the aeroshell. to determine the stability behavior during separation from the aeroshell, a wind tunnel model of the airplane was constructed and tested for pitching moment. Also, a VxWorks based - software system was implemented to provide video imaging and to control the airplane deployment an camera position. The ground software was written in Java to provide a portable data evaluation system.

Author

Aeroshells; Mars Atmosphere; Mars (Planet); Research Aircraft; Space Exploration

16

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics.

20000083968 NASA Glenn Research Center, Cleveland, OH USA

Acoustics and Trust of Separate-Flow Exhaust Nozzles With Mixing Devices for High-Bypass-Ratio Engines

Saiyed, Naseem H., NASA Glenn Research Center, USA; Mikkelsen, Kevin L., Aero Systems, Inc., USA; Bridges, James E., NASA Glenn Research Center, USA; June 2000; 24p; In English; Sixth Aeroacoustics Conference and Exhibit, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TM-2000-209948; NAS 1.15:209948; E-11714; AIAA Paper 2000-1961; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Glenn Research Center recently completed an experimental study to reduce the jet noise from modern turbofan engines. The study concentrated on exhaust nozzle designs for high-bypass-ratio engines. These designs modified the core and fan nozzles individually and simultaneously. Several designs provided an ideal jet noise reduction of over 2.5 EPNdB for the effective perceived noise level (EPNL) metric. Noise data, after correcting for takeoff thrust losses, indicated over a 2.0-EPNdB reduction for nine designs. Individually modifying the fan nozzle did not provide attractive EPNL reductions. Designs in which only the core nozzle was modified provided greater EPNL reductions. Designs in which core and fan nozzles were modified simultaneously provided the greatest EPNL reduction. The best nozzle design had a 2.7-EPNdB reduction (corrected for takeoff thrust loss) with a 0.06-point cruise thrust loss. This design simultaneously employed chevrons on the core and fan nozzles. In comparison with chevrons, tabs appeared to be an inefficient method for reducing jet noise. Data trends indicate that the sum of the thrust losses from individually modifying core and fan nozzles did not generally equal the thrust loss from modifying them simultaneously. Flow blockage from tabs did not scale directly with cruise thrust loss and the interaction between fan flow and the core nozzle seemed to strongly affect noise and cruise performance. Finally, the nozzle configuration candidates for full-scale engine demonstrations are identified.

Author

Jet Aircraft Noise; Noise Measurement; Noise Reduction; Noise Intensity; Effective Perceived Noise Levels

20000088637 Virginia Univ., Mechanical and Aerospace Engineering, Charlottesville, VA USA

Optimization and Control of Acoustic Liner Impedance with Bias Flow *Final Report*

Wood, Houston, Virginia Univ., USA; Follet, Jesse, Virginia Univ., USA; Aug. 04, 2000; 22p; In English

Contract(s)/Grant(s): NCC1-340; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because communities are impacted by steady increases in aircraft traffic, aircraft noise continues to be a growing problem for the growth of commercial aviation. Research has focused on improving the design of specific high noise source areas of aircraft and on noise control measures to alleviate noise radiated from aircraft to the surrounding environment. Engine duct liners have

long been a principal means of attenuating engine noise. The ability to control in-situ the acoustic impedance of a liner would provide a valuable tool to improve the performance of liners. The acoustic impedance of a liner is directly related to the sound absorption qualities of that liner. Increased attenuation rates, the ability to change liner acoustic impedance to match various operating conditions, or the ability to tune a liner to more precisely match design impedance represent some ways that in-situ impedance control could be useful. With this in mind, the research to be investigated will focus on improvements in the ability to control liner impedance using a mean flow through the liner which is referred to as bias flow.

Derived from text

Linings; Bias; Flow Velocity; Grazing Flow; Acoustic Impedance; Optimization; Aircraft Noise

20000092060 NASA Glenn Research Center, Cleveland, OH USA

Aeroperformance and Acoustics of the Nozzle with Permeable Shell

Gilinsky, M., Hampton Univ., USA; Blankson, I. M., NASA Glenn Research Center, USA; Chernyshev, S. A., Tsentralni Aerogidrodinamicheskii Inst., USSR; Chernyshev, S. A., Tsentralni Aerogidrodinamicheskii Inst., USSR; [1999]; 28p; In English; 5th; 5th Aeroacoustics Conference, 10-12 May 1999, Bellevue, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): CRDF-RE-136; NAG1-1835; NAG1-1936; NAG1-2249

Report No.(s): AIAA/CEAS-99-1924; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several simple experimental acoustic tests of a spraying system were conducted at the NASA Langley Research Center. These tests have shown appreciable jet noise reduction when an additional cylindrical permeable shell was employed at the nozzle exit. Based on these results, additional acoustic tests were conducted in the anechoic chamber AK-2 at the Central Aerohydrodynamics Institute (TsAGI, Moscow) in Russia. These tests examined the influence of permeable shells on the noise from a supersonic jet exhausting from a round nozzle designed for exit Mach number, $M(\text{sub } e)=2.0$, with conical and Screwdriver-shaped centerbodies. The results show significant acoustic benefits of permeable shell application especially for overexpanded jets by comparison with impermeable shell application. The noise reduction in the overall pressure level was obtained up to approximately 5-8%. Numerical simulations of a jet flow exhausting from a convergent-divergent nozzle designed for exit Mach number, $M(\text{sub } e)=2.0$, with permeable and impermeable shells were conducted at the NASA LaRC and Hampton University. Two numerical codes were used. The first is the NASA LaRC CFL3D code for accurate calculation of jet mean flow parameters on the basis of a full Navier-Stokes solver (NSE). The second is the numerical code based on Tam's method for turbulent mixing noise (TMN) calculation. Numerical and experimental results are in good qualitative agreement.

Author

Permeability; Convergent-Divergent Nozzles; Aerodynamics; Hydrodynamics; Aeroacoustics; Cylindrical Shells

20000092104 NASA Langley Research Center, Hampton, VA USA

Flap Edge Aeroacoustic Measurements and Predictions

Brooks, Thomas F., NASA Langley Research Center, USA; Humphreys, William M., Jr., NASA Langley Research Center, USA; [2000]; 30p; In English; 6th; 6th Aeroacoustics Conference, 12-14 Jun. 2000, Hahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1975; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An aeroacoustic model test has been conducted to investigate the mechanisms of sound generation on high-lift wing configurations. This paper presents an analysis of flap side-edge noise, which is often the most dominant source. A model of a main element wing section with a half-span flap was tested at low speeds of up to a Mach number of 0.17, corresponding to a wing chord Reynolds number of approximately 1.7 million. Results are presented for flat (or blunt), flanged, and round flap-edge geometries, with and without boundary-layer tripping, deployed at both moderate and high flap angles. The acoustic database is obtained from a Small Aperture Directional Array (SADA) of microphones, which was constructed to electronically steer to different regions of the model and to obtain farfield noise spectra and directivity from these regions. The basic flap-edge aerodynamics is established by static surface pressure data, as well as by Computational Fluid Dynamics (CFD) calculations and simplified edge flow analyses. Distributions of unsteady pressure sensors over the flap allow the noise source regions to be defined and quantified via cross-spectral diagnostics using the SADA output. It is found that shear layer instability and related pressure scatter is the primary noise mechanism. For the flat edge flap, two noise prediction methods based on unsteady surface pressure measurements are evaluated and compared to measured noise. One is a new causality spectral approach developed here. The other is a new application of an edge-noise scatter prediction method. The good comparisons for both approaches suggest that much of the physics is captured by the prediction models. Areas of disagreement appear to reveal when the assumed edge noise mechanism does not fully define the noise production. For the different edge conditions, extensive spectra and directivity are

presented. Significantly, for each edge configuration, the spectra for different flow speeds, flap angles, and surface roughness were successfully scaled by utilizing aerodynamic performance and boundary layer scaling methods developed herein.

Author

Aeroacoustics; Wind Tunnel Tests; Computational Fluid Dynamics; Aerodynamic Characteristics; Noise Measurement; Noise Prediction; Leading Edge Flaps

17

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000094294 European Office of Aerospace Research and Development, FPO New York, NY USA
EUROGRAM, no. 00-01, Jan-Feb 2000. European Office of Aerospace Research and Development
Feb. 2000; 13p; In English

Report No.(s): AD-A380038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract

DTIC

Research Aircraft; Armed Forces; Documents; Missiles

18

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences.

20000080879 Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR

Model of Disrupted Meteoroid Passage Through Planetary Atmosphere

Artemieva, N. A., Academy of Sciences (USSR), USSR; Shuvalov, V. V., Academy of Sciences (USSR), USSR; Lunar and Planetary Science XXXI; March 2000; In English; See also 20000080557; CD ROM: CD ROM contains the entire conference proceedings presented in PDF format; No Copyright; Available from CASI only as part of the entire parent document

Three dimensional modeling of fragments motion is conducted to define drag, lift and heat transfer coefficients. The results are used in a set of meteor physics equations for real events on the Earth and possible impacts on Mars and Venus.

Author

Drag; Lift; Heat Transfer; Aerodynamic Coefficients; Atmospheric Models; Fragments

20000094222 Wichita State Univ., Dept. of Aerospace Engineering, Wichita, KS USA

MAEV: Martian Airborne Exploration Vehicle

Loo, Soo Han, Wichita State Univ., USA; Liew, Loy Yik, Wichita State Univ., USA; Wai, Ng Seet, Wichita State Univ., USA; Edmonston, Dean, Wichita State Univ., USA; Dinh, Truong, Wichita State Univ., USA; Mahathalagalage, Nishanka, Wichita State Univ., USA; Dinh, Chuong, Wichita State Univ., USA; Medina-Fernandez, Roberto, Wichita State Univ., USA; Gavino-Nadal, Jaime, Wichita State Univ., USA; Third Annual HEDS-UP Forum; 2000, pp. 135-153; In English; See also 20000094214; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A conceptual approach was taken to design an airborne exploration vehicle capable of operating in the Martian atmosphere. To complete the design, a modular Carriage and Track system capable of deploying and retrieving the aircraft was also developed. Known as the Martian Airborne Exploration Vehicle, it is a solar powered wing body design with a span of 30.5 meters and a chord of 1.2 meters. With a full payload of 30 N, it weighs 300 N on Mars and has 4 propellers, which are capable of generating enough thrust to reach a maximum velocity of 67 m/s at a maximum altitude of 500 meters. The maximum radius of operation at the equator is 1000 kilometers. A 60-meter long Carriage and Track system fastened to the ground will be able to deploy the MAEV using a rocket assisted takeoff process, and then retrieve it using a resistance pulley mechanism.

Author

Mars (Planet); Mars Atmosphere; Mars Surface; Aircraft Design

20000091588 NASA Langley Research Center, Hampton, VA USA

Recent Turbulence Model Advances Applied to Multielement Airfoil Computations

Rumsey, Christopher L., NASA Langley Research Center, USA; Gatski, Thomas B., NASA Langley Research Center, USA;

[2000]; 13p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4323; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A one-equation linear turbulence model and a two-equation nonlinear explicit algebraic stress model (EASM) are applied to the flow over a multielement airfoil. The effect of the K-epsilon and K-omega forms of the two-equation model are explored, and the K-epsilon form is shown to be deficient in the wall-bounded regions of adverse pressure gradient flows. A new K-omega form of EASM is introduced. Nonlinear terms present in EASM are shown to improve predictions of turbulent shear stress behind the trailing edge of the main element and near midflap. Curvature corrections are applied to both the one- and two-equation turbulence models and yield only relatively small local differences in the flap region, where the flow field undergoes the greatest curvature. Predictions of maximum lift are essentially unaffected by the turbulence model variations studied.

Author

K-Epsilon Turbulence Model; K-Omega Turbulence Model; Turbulent Flow; Mathematical Models; Airfoils

20000083354 NASA Johnson Space Center, Houston, TX USA

Radiation Physics for Space and High Altitude Air Travel

Cucinotta, F. A., NASA Johnson Space Center, USA; Wilson, J. W., NASA Langley Research Center, USA; Goldhagen, P., Department of Energy, USA; Saganti, P., NASA Johnson Space Center, USA; Shavers, M. R., NASA Johnson Space Center, USA; [2000]; 1p; In English; 11th; 11th International Congress on Radiation Res., 11-15 Jul. 2000, Dublin, Ireland; No Copyright; Avail: Issuing Activity; Abstract Only

Galactic cosmic rays (GCR) are of extra-solar origin consisting of high-energy hydrogen, helium, and heavy ions. The GCR are modified by physical processes as they traverse through the solar system, spacecraft shielding, atmospheres, and tissues producing copious amounts of secondary radiation including fragmentation products, neutrons, mesons, and muons. We discuss physical models and measurements relevant for estimating biological risks in space and high-altitude air travel. Ambient and internal spacecraft computational models for the International Space Station and a Mars mission are discussed. Risk assessment is traditionally based on linear addition of components. We discuss alternative models that include stochastic treatments of columnar damage by heavy ion tracks and multi-cellular damage following nuclear fragmentation in tissue.

Author

Radiation Chemistry; Aerospace Environments; High Altitude; Air Transportation; Galactic Cosmic Rays; Hydrogen Ions; Helium Ions; Heavy Ions

Subject Term Index

A

ACCELEROMETERS, 30
 ACCIDENT INVESTIGATION, 58
 ACCIDENT PREVENTION, 12
 ACCURACY, 54
 ACOUSTIC IMPEDANCE, 60
 ACOUSTIC MEASUREMENT, 33
 ACTIVE CONTROL, 21, 32, 52, 59
 ACTUATORS, 38, 39, 48, 59
 ADAPTIVE CONTROL, 8
 ADHESIVE BONDING, 20
 AERIAL RECONNAISSANCE, 28
 AEROACOUSTICS, 3, 60, 61
 AERODYNAMIC BALANCE, 43
 AERODYNAMIC CHARACTERISTICS, 1, 5, 7, 36, 61
 AERODYNAMIC COEFFICIENTS, 61
 AERODYNAMIC CONFIGURATIONS, 6, 50
 AERODYNAMIC LOADS, 29
 AERODYNAMIC NOISE, 3, 33
 AERODYNAMIC STALLING, 3, 54
 AERODYNAMICS, 1, 4, 5, 26, 36, 60
 AEROELASTICITY, 38
 AERONAUTICAL ENGINEERING, 1
 AEROSERVOELASTICITY, 8, 36
 AEROSHELLS, 59
 AEROSPACE ENGINEERING, 28, 31
 AEROSPACE ENVIRONMENTS, 24, 62
 AEROSPACE INDUSTRY, 24, 30
 AEROSPACE MEDICINE, 15, 56
 AEROSPACE SYSTEMS, 25, 30, 43
 AEROSPACE VEHICLES, 22, 39
 AIR NAVIGATION, 13, 30
 AIR POLLUTION, 49
 AIR TRAFFIC, 10
 AIR TRAFFIC CONTROL, 11, 13
 AIR TRAFFIC CONTROLLERS (PERSONNEL), 20
 AIR TRANSPORTATION, 10, 11, 62
 AIRCRAFT ACCIDENT INVESTIGATION, 57
 AIRCRAFT ACCIDENTS, 9, 11, 12, 13, 14, 33, 57, 58
 AIRCRAFT APPROACH SPACING, 16
 AIRCRAFT CONFIGURATIONS, 8
 AIRCRAFT CONSTRUCTION MATERIALS, 35
 AIRCRAFT DESIGN, 22, 23, 29, 61
 AIRCRAFT ENGINES, 34, 35, 38, 50, 54, 58

AIRCRAFT EQUIPMENT, 20, 22, 27
 AIRCRAFT ICING, 24, 42
 AIRCRAFT INDUSTRY, 12
 AIRCRAFT INSTRUMENTS, 29, 55
 AIRCRAFT LANDING, 9, 37, 41
 AIRCRAFT MAINTENANCE, 11, 13, 24, 25, 35, 45, 49
 AIRCRAFT MODELS, 4
 AIRCRAFT NOISE, 15, 22, 47, 60
 AIRCRAFT PERFORMANCE, 20, 21, 22, 54
 AIRCRAFT PILOTS, 14, 15, 50, 56
 AIRCRAFT SAFETY, 9, 12, 13, 33
 AIRCRAFT STRUCTURES, 3, 9, 25, 53
 AIRFOILS, 5, 62
 AIRFRAMES, 7, 20, 48, 54
 AIRLINE OPERATIONS, 11
 AIRPORTS, 15, 16
 ALASKA, 14
 ALCOHOLS, 13
 ALGORITHMS, 19, 30
 ALTIMETERS, 51
 ANTENNA ARRAYS, 42
 APPLICATIONS PROGRAMS (COMPUTERS), 58
 APPROACH, 30
 APPROXIMATION, 28
 ARCHITECTURE (COMPUTERS), 10, 29
 ARMED FORCES, 61
 ASPHALT, 41
 ASTRODYNAMICS, 22
 ATMOSPHERIC BOUNDARY LAYER, 16, 55
 ATMOSPHERIC MODELS, 61
 ATMOSPHERIC TURBULENCE, 22, 50
 AUGMENTATION, 9, 21, 31
 AUTOMATIC CONTROL, 13, 16
 AUTOMATIC FLIGHT CONTROL, 39
 AUTOMATIC PILOTS, 37
 AUTONOMOUS NAVIGATION, 19, 20
 AUTONOMY, 39
 AVIATION PSYCHOLOGY, 57
 AVIONICS, 29, 49

B

BACKSCATTERING, 19
 BALANCE, 44
 BELIEF NETWORKS, 32
 BIAS, 60
 BIBLIOGRAPHIES, 1

BIODEGRADATION, 49
 BISTATIC REFLECTIVITY, 19
 BLADE-VORTEX INTERACTION, 3
 BLOOD VOLUME, 13
 BOEING 767 AIRCRAFT, 9
 BOEING AIRCRAFT, 36
 BONDED JOINTS, 20
 BOUNDARY ELEMENT METHOD, 6
 BOUNDARY LAYER CONTROL, 1
 BOUNDARY LAYER SEPARATION, 40, 50
 BOUNDARY LAYER TRANSITION, 50
 BOUNDARY LAYERS, 2
 BURNING RATE, 32

C

C-130 AIRCRAFT, 22, 32
 CANARD CONFIGURATIONS, 5
 CASCADE CONTROL, 54
 CASE HISTORIES, 21
 CATARACTS, 56
 CATHODE RAY TUBES, 49
 CENTERBODIES, 47
 CIVIL AVIATION, 12, 37
 CLIENT SERVER SYSTEMS, 7
 CLOUDS (METEOROLOGY), 55
 COATINGS, 42
 CODE DIVISION MULTIPLE ACCESS, 49
 COLLISION AVOIDANCE, 10, 33
 COLLISIONS, 18
 COMBUSTION, 32
 COMBUSTION CHAMBERS, 35
 COMBUSTION CHEMISTRY, 32
 COMBUSTION CONTROL, 32
 COMBUSTION STABILITY, 32
 COMMERCIAL AIRCRAFT, 9, 37
 COMMUTER AIRCRAFT, 29
 COMPUTATION, 6
 COMPUTATIONAL FLUID DYNAMICS, 4, 7, 28, 47, 50, 54, 61
 COMPUTATIONAL GRIDS, 54
 COMPUTER AIDED DESIGN, 23, 34
 COMPUTER NETWORKS, 10
 COMPUTER PROGRAMMING, 53
 COMPUTERIZED SIMULATION, 5, 10, 14, 22, 25, 29, 36, 44, 58
 CONCRETES, 41
 CONFERENCES, 3, 18
 CONGRESSIONAL REPORTS, 9

CONSTRAINTS, 43
 CONTACT LENSES, 15
 CONTRAILS, 50
 CONTROL STABILITY, 38, 52
 CONTROL SURFACES, 40
 CONTROL SYSTEMS DESIGN, 39, 40, 44, 52, 53
 CONTROL THEORY, 38, 41
 CONTROLLERS, 37
 CONVERGENT-DIVERGENT NOZZLES, 4, 60
 CORNEA, 56
 CORRECTION, 15
 COST ANALYSIS, 24, 25
 COUNTERMEASURES, 51
 CUSHIONS, 8
 CYLINDRICAL BODIES, 50
 CYLINDRICAL SHELLS, 60

D

DAST PROGRAM, 57
 DATA ACQUISITION, 19, 29
 DATA BASES, 7, 18
 DATA PROCESSING, 16, 29
 DATA RECORDING, 36
 DATA REDUCTION, 17
 DATA SYSTEMS, 9, 19, 29
 DEGRADATION, 20, 48
 DEICING, 24
 DESIGN ANALYSIS, 22, 23, 26, 28, 34, 39, 44, 55
 DETECTION, 20
 DETECTORS, 20
 DIFFERENTIAL EQUATIONS, 28
 DIRECT NUMERICAL SIMULATION, 50
 DISPLAY DEVICES, 10, 31, 49
 DISTRIBUTED PROCESSING, 58
 DOCUMENTS, 61
 DRAG, 61
 DROP SIZE, 5
 DRUGS, 13
 DUCTED FANS, 33
 DYNAMIC CONTROL, 8, 46
 DYNAMIC MODELS, 6, 37
 DYNAMIC RESPONSE, 8, 21
 DYNAMIC STRUCTURAL ANALYSIS, 5, 46

E

E-2 AIRCRAFT, 45
 EARTH OBSERVING SYSTEM (EOS), 20
 EARTH ORBITS, 19

EFFECTIVE PERCEIVED NOISE LEVELS, 59
 EJECTION SEATS, 8
 EJECTORS, 35
 ELECTRODYNAMICS, 5
 ELLIPTICAL ORBITS, 46
 ENDOTHELIUM, 56
 ENGINE AIRFRAME INTEGRATION, 38
 ENGINE DESIGN, 34, 35, 47
 ENGINE MONITORING INSTRUMENTS, 32
 ENGINE NOISE, 34, 47
 ENGINE TESTS, 4
 EPOXY COMPOUNDS, 20
 ERROR ANALYSIS, 30, 58
 ERRORS, 17
 ESCAPE SYSTEMS, 8
 ESTIMATING, 24
 EUROPE, 12
 EVALUATION, 10, 25
 EXHAUST EMISSION, 32, 50
 EXHAUST NOZZLES, 35
 EXPERIMENT DESIGN, 7, 17, 37
 EXPOSURE, 32
 EXTRACTION, 49
 EYE (ANATOMY), 56

F

F-111 AIRCRAFT, 27
 F-15 AIRCRAFT, 8
 F-16 AIRCRAFT, 37
 F-18 AIRCRAFT, 6, 8
 F-4 AIRCRAFT, 36
 FAILURE, 16
 FALSE ALARMS, 16
 FAN BLADES, 33
 FAULT DETECTION, 4, 32, 59
 FAULT TOLERANCE, 59
 FEASIBILITY, 50
 FEEDBACK, 18
 FILTRATION, 56
 FINITE ELEMENT METHOD, 27, 38, 41
 FINS, 51
 FIRE EXTINGUISHERS, 41
 FIRE FIGHTING, 41
 FIRE PREVENTION, 11, 13, 41
 FITTING, 27
 FLAME HOLDERS, 35
 FLAMES, 35
 FLAPS (CONTROL SURFACES), 5
 FLEXIBILITY, 53
 FLIGHT CHARACTERISTICS, 20, 21, 23, 36, 45, 57

FLIGHT CONDITIONS, 23, 26, 39, 40
 FLIGHT CONTROL, 8, 14, 22, 38, 39, 41, 46
 FLIGHT CREWS, 15, 57
 FLIGHT ENVELOPES, 26
 FLIGHT HAZARDS, 45
 FLIGHT LOAD RECORDERS, 29
 FLIGHT MECHANICS, 6
 FLIGHT OPERATIONS, 29
 FLIGHT PATHS, 15
 FLIGHT PLANS, 11, 12, 15, 28
 FLIGHT SAFETY, 12, 30, 33, 57
 FLIGHT SIMULATORS, 14, 49, 55
 FLIGHT TESTS, 4, 6, 7, 18, 23, 26, 30
 FLIGHT TRAINING, 14
 FLOW CHARACTERISTICS, 2, 50
 FLOW DISTRIBUTION, 2, 31, 40
 FLOW VELOCITY, 60
 FLOW VISUALIZATION, 2, 50
 FLUIDICS, 4
 FLUSHING, 15
 FLUTTER, 8
 FLYWHEELS, 52
 FOAMS, 41
 FOREBODIES, 2
 FOURIER ANALYSIS, 24
 FRAGMENTS, 61
 FREE FLIGHT, 10, 12
 FREE FLOW, 6
 FREE VIBRATION, 38
 FREQUENCIES, 3
 FREQUENCY RESPONSE, 23
 FUEL CONTROL, 32
 FUEL INJECTION, 35, 47
 FULL SCALE TESTS, 6, 44

G

GALACTIC COSMIC RAYS, 62
 GAS TURBINE ENGINES, 32, 34, 35
 GAS TURBINES, 31, 34
 GEARS, 26
 GENERAL AVIATION AIRCRAFT, 9
 GENETIC ALGORITHMS, 39
 GEOSYNCHRONOUS ORBITS, 19, 45
 GLIDERS, 28
 GLIDING, 28
 GLOBAL POSITIONING SYSTEM, 9, 13, 17, 18, 19, 24
 GLOMERULUS, 56
 GOGGLES, 50
 GRAPHITE-EPOXY COMPOSITES, 48
 GRAZING FLOW, 60
 GROUND CREWS, 56

GROUND STATIONS, 42
GUIDANCE (MOTION), 24

H

H-60 HELICOPTER, 25
HANDBOOKS, 13
HANGARS, 11, 41
HARMONIC OSCILLATION, 2
HEALTH, 32
HEAT RESISTANT ALLOYS, 35
HEAT TRANSFER, 31, 61
HEATING EQUIPMENT, 22
HEAVY IONS, 62
HELICOPTERS, 26
HELIUM IONS, 62
HIGH ALTITUDE, 62
HIGH RESOLUTION, 30
HIGH REYNOLDS NUMBER, 3, 40, 44
HIGH SPEED, 37
HIGH TEMPERATURE SUPERCONDUCTORS, 30
HIGH TEMPERATURE TESTS, 51
HISTORIES, 12, 57
HONEYCOMB CORES, 48
HONEYCOMB STRUCTURES, 48
HORIZONTAL FLIGHT, 26
HOVERING, 26
HUMAN FACTORS ENGINEERING, 11, 14, 58
HUMAN PERFORMANCE, 14
HYDRODYNAMICS, 60
HYDROGEN IONS, 62
HYPERSONIC AIRCRAFT, 3
HYPERSONIC FLIGHT, 2
HYPERSONIC SPEED, 4, 43
HYPERSONIC VEHICLES, 6
HYPERSONICS, 4

I

ICE FORMATION, 5, 42
IMAGE INTENSIFIERS, 50
IMAGERY, 43
IMAGING SPECTROMETERS, 55
IMPROVEMENT, 19
INDEXES (DOCUMENTATION), 1
INEQUALITIES, 37
INFORMATION RETRIEVAL, 7
INFORMATION SYSTEMS, 7, 10, 15
INJECTION, 4
INJURIES, 15
INLET FLOW, 3
INLET NOZZLES, 36
INSPECTION, 25
INSTRUMENT APPROACH, 10, 18

INTERNET RESOURCES, 7
INVENTIONS, 35
ISOTROPIC TURBULENCE, 31
ITERATION, 52

J

JET AIRCRAFT NOISE, 59
JET ENGINE FUELS, 47
JET ENGINES, 34, 35
JP-8 JET FUEL, 32

K

K-EPSILON TURBULENCE MODEL, 62
K-OMEGA TURBULENCE MODEL, 62

L

LAMINAR BOUNDARY LAYER, 1
LAMINAR FLOW, 50
LAMINAR FLOW AIRFOILS, 1
LANDING AIDS, 30
LANDING GEAR, 48
LANDING SITES, 41
LASER RANGE FINDERS, 51
LAUNCH VEHICLE CONFIGURATIONS, 3
LAUNCH VEHICLES, 6
LEADING EDGE FLAPS, 61
LEAST SQUARES METHOD, 23
LIBRATION, 45
LIFT, 61
LIFT DRAG RATIO, 5
LIFTING BODIES, 6
LIGHT HELICOPTERS, 21
LINEAR EQUATIONS, 28
LINEAR QUADRATIC REGULATOR, 45
LINEAR SYSTEMS, 37
LININGS, 60
LIQUID INJECTION, 4, 47
LOADS (FORCES), 5, 9, 44
LOW EARTH ORBITS, 19
LOW PRESSURE, 26
LUMINESCENCE, 42

M

MAGNET COILS, 5
MAGNETIC BEARINGS, 52, 53, 59
MAGNETIC LEVITATION VEHICLES, 5

MAGNETIC SUSPENSION, 5, 43, 44, 53
MAGNETOMETERS, 19
MAGNIFICATION, 43
MAINTAINABILITY, 45
MALFUNCTIONS, 33
MAN MACHINE SYSTEMS, 51
MANNED SPACE FLIGHT, 40
MANUFACTURING, 30
MARS (PLANET), 59, 61
MARS ATMOSPHERE, 59, 61
MARS SAMPLE RETURN MISSIONS, 50
MARS SURFACE, 61
MATHEMATICAL MODELS, 5, 7, 28, 39, 52, 53, 54, 62
MATRICES (MATHEMATICS), 37
MEASURING INSTRUMENTS, 55
MEMBRANES, 49
MILITARY AIRCRAFT, 24
MILITARY OPERATIONS, 27
MIMO (CONTROL SYSTEMS), 52
MINE DETECTORS, 39
MISSILES, 61
MOISTURE, 48
MOLECULAR PUMPS, 52
MONOCULAR VISION, 50
MONTE CARLO METHOD, 50
MULTIDISCIPLINARY DESIGN OPTIMIZATION, 34, 58
MULTIPATH TRANSMISSION, 18

N

NAP-OF-THE-EARTH NAVIGATION, 31
NAVIER-STOKES EQUATION, 47
NAVIGATION, 13, 19
NAVIGATION INSTRUMENTS, 20
NAVIGATION SATELLITES, 19, 30
NAVY, 25
NEURAL NETS, 54, 59
NIGHT VISION, 50
NITINOL ALLOYS, 48
NOISE INTENSITY, 59
NOISE MEASUREMENT, 59, 61
NOISE POLLUTION, 15
NOISE PREDICTION, 61
NOISE REDUCTION, 15, 22, 26, 33, 47, 59
NONLINEARITY, 53
NOZZLE DESIGN, 34, 36, 47
NOZZLE GEOMETRY, 34
NUMERICAL ANALYSIS, 5, 36

O

OCEAN SURFACE, 55
OCEANS, 55
ON-LINE SYSTEMS, 7
ONBOARD EQUIPMENT, 20
OPERATORS (PERSONNEL), 57
OPTICAL EQUIPMENT, 42
OPTIMIZATION, 28, 39, 54, 55, 60
ORBIT DETERMINATION, 45
OSCILLATING FLOW, 2

P

P-3 AIRCRAFT, 22
PAINTS, 42
PANEL METHOD (FLUID DYNAMICS), 5
PARAFOILS, 24
PARALLEL PROCESSING (COMPUTERS), 39, 58
PARAMETER IDENTIFICATION, 24
PATENTS, 35
PAVEMENTS, 41
PERCEPTION, 20
PERFORMANCE PREDICTION, 5, 6
PERFORMANCE TESTS, 10, 25, 47, 51
PERMEABILITY, 60
PERSONNEL, 27
PHOTONS, 51
PIEZOELECTRICITY, 38
PILOT INDUCED OSCILLATION, 36
PILOT TRAINING, 57
PILOTLESS AIRCRAFT, 23, 28, 40
PIVOTS, 27
PLANNING, 11
PLASMAS (PHYSICS), 56
PLUGS, 47
PLUMES, 50
POLAR REGIONS, 55
PREFLIGHT ANALYSIS, 38
PRESSURE DISTRIBUTION, 46
PRESSURE MEASUREMENT, 42, 50
PRESSURE SENSORS, 46
PRIORITIES, 15
PROCUREMENT, 22
PRODUCT DEVELOPMENT, 35
PRODUCTION ENGINEERING, 35
PROJECTILES, 5
PROPELLER BLADES, 22
PROPELLERS, 3
PROPULSION, 58
PROPULSION SYSTEM CONFIGURATIONS, 3

PROPULSION SYSTEM
PERFORMANCE, 33, 36
PROTOTYPES, 40

Q

QUALIFICATIONS, 57
QUALITY CONTROL, 23
QUEUEING THEORY, 26

R

RADAR ANTENNAS, 42
RADAR SCANNING, 42
RADAR SCATTERING, 19
RADAR TRACKING, 42
RADIATION CHEMISTRY, 62
RAMJET ENGINES, 35
RANGEFINDING, 51
REACTION KINETICS, 32
REAL TIME OPERATION, 53, 58
REATTACHED FLOW, 40
RECEIVERS, 17, 18
RECONNAISSANCE AIRCRAFT, 21, 23, 28
REENTRY SHIELDING, 51
REENTRY VEHICLES, 51
REGRESSION ANALYSIS, 54
REGULATIONS, 13
REMOTE SENSING, 55
RESEARCH, 45
RESEARCH AIRCRAFT, 59, 61
RESEARCH VEHICLES, 3, 4, 6, 7
RESIDUAL STRESS, 54
RETRACTABLE EQUIPMENT, 48
REUSABLE LAUNCH VEHICLES, 38
REVERBERATION CHAMBERS, 44
REYNOLDS NUMBER, 50
RIGID ROTORS, 52
ROCKET ENGINES, 35, 46, 47
ROLL, 43
ROOFS, 44
ROTARY WINGS, 3, 21, 58
ROTOR AERODYNAMICS, 3
ROTORS, 34, 52, 53, 55, 59
ROUTES, 10
RUDDERS, 51
RUNWAYS, 41
RUSSIAN FEDERATION, 57

S

SAFETY FACTORS, 33
SAFETY MANAGEMENT, 11, 13, 15
SANDWICH STRUCTURES, 48
SATELLITE INSTRUMENTS, 51

SATELLITE NAVIGATION SYSTEMS, 19
SCALE MODELS, 2
SCALING LAWS, 20
SCANNERS, 42, 53
SEA ROUGHNESS, 55
SEALS (STOPPERS), 51
SENSORS, 52, 59
SEPARATED FLOW, 3
SERVICE LIFE, 29
SHAPE MEMORY ALLOYS, 21
SHAPES, 47
SIGNAL PROCESSING, 24
SIGNAL TO NOISE RATIOS, 51
SIMULATION, 36
SIMULATORS, 18
SMART STRUCTURES, 21
SOFTWARE DEVELOPMENT TOOLS, 23, 27
SOFTWARE ENGINEERING, 58
SOLID SURFACES, 6
SONIC BOOMS, 26
SPACE DEBRIS, 45
SPACE EXPLORATION, 59
SPACE NAVIGATION, 18
SPACE TRANSPORTATION SYSTEM FLIGHTS, 46
SPACECRAFT CONTROL, 38, 46
SPACECRAFT ORBITS, 46
SPECIFICATIONS, 9, 29
SPECTORADIOMETERS, 55
STABILITY AUGMENTATION, 38
STABILITY TESTS, 53
STAGE SEPARATION, 3, 6
STAGNATION FLOW, 31
STAGNATION POINT, 31
STATISTICAL ANALYSIS, 9, 29, 51
STEADY STATE, 26
STRATEGY, 12
STRESS ANALYSIS, 27
STRUCTURAL ANALYSIS, 26
STRUCTURAL RELIABILITY, 29
STRUCTURAL STABILITY, 54
STRUCTURAL VIBRATION, 22
SUPERSONIC BOUNDARY LAYERS, 50
SUPERSONIC COMBUSTION
RAMJET ENGINES, 3, 4, 7, 38
SUPERSONIC FLIGHT, 26
SUPERSONIC FLUTTER, 38
SUPERSONIC SPEED, 37, 50
SUPERSONIC TRANSPORTS, 21, 23, 37
SURFACE REACTIONS, 5
SURFACE ROUGHNESS, 50
SURVEILLANCE, 42

SWEPT WINGS, 50
SYNCHRONOUS SATELLITES, 45
SYSTEM IDENTIFICATION, 8, 24, 37
SYSTEMS ENGINEERING, 11, 22, 44,
46
SYSTEMS HEALTH MONITORING, 33

T

TACTICS, 27
TARGETS, 43
TASKS, 26
TDR SATELLITES, 20
TERCOM, 31
TERRA SPACECRAFT, 20
TERRAIN, 14
TERRAIN ANALYSIS, 31
TEST PILOTS, 36
THERMAL ANALYSIS, 51
THREE DIMENSIONAL FLOW, 40, 50
THREE DIMENSIONAL MODELS, 1,
34
THRUST MEASUREMENT, 5
THRUST VECTOR CONTROL, 4
TIME DIVISION MULTIPLEXING, 49
TOLERANCES (MECHANICS), 25
TOXICOLOGY, 13
TRACKING RADAR, 19
TRACKING STATIONS, 42
TRAINING AIRCRAFT, 24
TRAJECTORIES, 5
TRANSMISSIONS (MACHINE
ELEMENTS), 26, 44
TRANSONIC FLOW, 1
TRAPPING, 2
TUNERS, 44
TURBINE BLADES, 46, 55
TURBINE ENGINES, 46
TURBINE PUMPS, 52
TURBOJET ENGINES, 32
TURBOPROP ENGINES, 32
TURBULENCE, 26
TURBULENCE MODELS, 22
TURBULENT FLOW, 31, 62
TWO DIMENSIONAL FLOW, 4, 40
TWO DIMENSIONAL MODELS, 2

U

UH-60A HELICOPTER, 22
UNITED STATES, 12
UNMANNED SPACECRAFT, 57
UNSTEADY AERODYNAMICS, 46
UNSTEADY FLOW, 2, 3
USER MANUALS (COMPUTER
PROGRAMS), 27

V

VANES, 33
VARIABLE SWEEP WINGS, 27
VELOCITY, 6
VIBRATION, 26
VIBRATION DAMPING, 38, 52
VIBRATION TESTS, 22
VIEWING, 43
VISUAL ACUITY, 15, 56
VOLATILE ORGANIC COMPOUNDS,
49
VORTEX SHEETS, 2
VORTICES, 2, 50
VORTICITY, 2

W

WARNING SYSTEMS, 31
WASTE DISPOSAL, 24
WIND MEASUREMENT, 16
WIND PROFILES, 16
WIND TUNNEL MODELS, 42, 43, 50
WIND TUNNEL TESTS, 1, 2, 3, 7, 42,
43, 44, 50, 61
WIND TURBINES, 55
WIND VARIATIONS, 16
WIND VELOCITY, 42, 55
WIND VELOCITY MEASUREMENT,
42
WING PROFILES, 1
WINGS, 2, 5, 38

X

X-38 CREW RETURN VEHICLE, 24,
29, 51
X-43 VEHICLE, 2

Personal Author Index

A

Aagaard Madsen, H., 54
Acharya, Mukund, 3
Agrawal, D., 49
Agte, Jeremy S., 22
Ahn, Hyeong-Joon, 51
Akamine, Naoshi, 39
Allaire, Paul, 53
Anderson, Brian L., 29
Aoyama, T., 26
Armocost, Andrew P., 10
Arnathys, Michael, 17
Armatys, Michael, 18
Artemieva, N. A., 61
Aso, Shigeru, 39
Auslender, Aaron H., 1

B

Back, G. G., 41
Bailey, Larry L., 14
Bailey, Melvin L., 36, 37
Bak, C., 54
Bar-Itzhack, Itzhack, 19
Barkley, James E., 44
Barnhart, C., 10
Bedos, Thierry, 29
Bencic, Timothy J., 42
Bennett, Thomas, 23
Beringer, Dennis B., 15
Berry, Scott A., 1
Bittner, Robert D., 7, 38
Bizos, Angelis, 3
Blanken, Chris L., 26
Blankson, I. M., 35, 60
Boubel, T., 57
Bragg, Michael B., 5
Breisacher, Kevin J., 31
Bridges, James E., 59
Brieger, Oliver, 36
Britcher, Colin P., 44
Brooks, Thomas F., 60
Brown, M. A., 30
Buning, Pieter G., 6
Bunker, Ronald S., 31
Burns, John A., 28
Burrows, Clifford R., 58

C

Calleja, John F., 1
Canfield, Dennis V., 13
Cardellach, Estelle, 17, 18
Carpenter, J. Russell, 19, 45
Chambers, Robert, 19
Charon, Aaron, 48
Chen, P. C., 7
Chernyshev, S. A., 60

Chopra, Inderjit, 21
Chou, Shean-Kwang, 6
Chowdhry, Rajiv, 38
Chun, K. S., 49
Ciolani, Luigi, 39
Clayton, Russel K., 48
Cockrell, Charles E., Jr., 7, 38
Colbourne, Jason D., 39
Cole, Matthew O. T., 58
Coleman, Colin P., 49
Cotting, Chris, 38
Craven, Tom, 42
Crawford, Tim, 55
Croom, M., 6
Cucinotta, F. A., 62
Curry, Donald M., 51
Curtis, Alan R. D., 33

D

Dai, Da-Jiang, 56
Dai, Yu, 56
Davey, Kent, 5
Deere, K. A., 3
Degnan, John J., 51
DeLaat, John C., 31
DeLoach, R., 7
Denham, Kenneth R., 57
Deutschmann, Julie, 19
DiFulvio, M., 2
Dilley, Arthur D., 6, 38
Dilley, Authur D., 1
Dinh, Chuong, 61
Dinh, Truong, 61
Dobson, Chris C., 47
Donovan, Sharlene Joy, 13
Dunlap, Patrick H., Jr., 51
Dwyer, W., 25
Dzwonczyk, Mark, 26

E

Edmonston, Dean, 61
Edwards, Craig D., 42
Elliott, Dawn M., 18
Emiley, Mark S., 22
Endecott, Boyd, 13
Engelund, Walter C., 4, 7, 38
Enkyo, Shigeharu, 30
Ercoline, W., 57
Escher, William J. D., 34
Eskridge, Richard H., 47
Estrada, Arthur, 50

F

Ferguson, Marcus G., 17
Ferreira, Enrique, 37

Files, Bradley S., 48
Filman, Robert E., 6
Follen, Gregory J., 58
Follet, Jesse, 59
Folta, David, 45
Forster, Edwin E., 37
Foster, Ian, 58
Fox, Roy, 23
Freudi, Abdelkader, 38
Frost, Chad R., 39
Frye, Michael, 40
Fuglsang, P., 54
Fujita, Hirofumi, 39
Fujita, Koki, 39
Fujiwara, Hiroyuki, 52

G

Galindo, Jason L., 21
Garrison, James, 19
Garrison, James L., 17, 18
Gatski, Thomas B., 61
Gavino-Nadal, Jaime, 61
Gendron, Marlin L., 27
Geri, George A., 43, 49
Gilinsky, M., 35, 47, 60
Gilinsky, Mikhail M., 34, 35
Ginsburg, Brian, 58
Glass, Christopher E., 50
Gnoffo, Peter A., 50
Goldhagen, P., 62
Goldsmith, Kevin, 44
Gomeiz, Oscar, 44
Gonzalez, Oscar, 44
Goto, Norihiro, 39
Gott, J. E., 41
Gott, Joseph E., 11
Graham, Colin, 59
Gramling, Cheryl, 19
Gray, Steven, 44
Griffin, Lisa W., 46
Grutzmacher, Richard P., 49
Guptill, James D., 53
Gutierrez, Richard, 58

H

Hall, James K., 40
Hall, Robert, 45
Han, Dong-Chul, 51
Harigae, M., 12, 30
Harman, Rick, 19
Harris, Christopher A., 11
Hartfield, Roy J., Jr., 47
Heidelberg, Laurence J., 33
Heller, M., 54
Hilton, Edgar F., 53
Hindson, William, 26
Hokamoto, Shinji, 39

Holland, S. D., 2
 Holland, Scott D., 4, 7
 Hopkins, Dale A., 53
 Hordinsky, Jerry, 13
 Horner, April, 13
 Hsin, Ching-Yeh, 6
 Hudson, Susan T., 46
 Huff, Edward M., 26
 Hughes, Steven, 46
 Humphrey, Marty, 53
 Humphreys, William M., Jr., 60
 Hwu, Shian U., 18
 Hyde, Eric H., 34

I

Inagaki, T., 30
 Irwin, Keith, 33
 Ishida, Y., 1
 Iwamiya, T., 26

J

Jacobs, Brian K., 44
 Jentink, Tom N., 38
 Ji, Guiying, 56
 Jin, Park Tea, 52
 Johnson, B. S., 49
 Johnson, Nicholas L., 45

K

Kanemitsu, Yoichi, 52
 Kao, Hsiao C., 2
 Kaplan, Norman, 48
 Kato, T., 12
 Katsuno, Keiji, 52
 Kawashima, Mitsutoyo, 39
 Kelbel, David, 19
 Kenney, H., 6
 Keogh, Patrick S., 58
 Kiedaisch, John W., 3
 Kijima, Katsuro, 39
 Kijimoto, Sinya, 52
 Kikuchi, T., 2
 Kirchwey, Kim, 45
 Kizhner, Semion, 17
 Kohno, Takashi, 43
 Kolkman, H. K., 35
 Korsmeyer, David J., 6
 Kouznetsov, V. M., 47
 Kowal, E., 54
 Kowalski, Danny E., 25
 Kubota, H., 26
 Kuchar, James K., 9, 16
 Kunimasu, Tetsuya, 43
 Kurosawa, Y., 35
 Kutumbos, Ted, 59

L

Labows, Steven J., 22, 26

Lamonica, John, 15
 LaMontagne, Troy, 39
 Larsson, Olle, 58
 Lavelle, Thomas M., 53
 Lawson, K., 6
 Lee, Howard, 38
 Lee, K. H., 4
 Lee, Sang-Ho, 51
 Lee, Sang-Wook, 51
 Lee, Taesul, 19
 Liew, Loy Yik, 61
 Liu, D. D., 7
 Loh, Y. C., 18
 Lohrenz, Maura C., 27
 Long, Anne, 19
 Loo, Soo Han, 61
 Lopez, Isaac, 58
 Lorah, John, 19
 Loth, Eric, 5
 Luckham, David C., 29
 Lukin, Vladimir, 50
 Lund, Timothy C., 5

M

Madhow, U., 49
 Mahathalagalage, Nishanka, 61
 Mailhe, Laurie, 46
 Makino, Y., 26
 Mansur, M. Hossein, 40
 Martin, Michael, 45
 Martin, Stuart, 58
 Marz, Theodore F., 37
 Masters, Dallas, 17, 18
 Matsuda, Koichi, 52
 Matsushita, Osami, 52
 McDonald, M., 27
 McLean, William e., 50
 Medina-Fernandez, Roberto, 61
 Mehaffey, J. M., 27
 Melton, Jason, 44
 Memmen, Sean P., 55
 Mikkelsen, Kevin L., 59
 Millett, David P., 13
 Montegut, Michael, 40
 Montgomery, Ronald W., 56
 Moon, Terry, 27
 Morelli, Eugene A., 23, 37
 Mottinger, Ben, 59
 Mourad, Pierre, 55
 Muckenthaler, Jason, 59
 Mullen, G. J., 24
 Murata, M., 12, 30
 Murri, D., 6
 Muscat, R. F., 20
 Myrick, Stephanie A., 27

N

Nail, Bert, 44
 Nakagawara, Van B., 14, 56
 Nakajima, Atushi, 30
 Nam, C., 7
 Nance, Christopher, 15

Nark, D. M., 47
 Noguchi, M., 1

O

Okubo, Hiroki, 52
 Olsson-Jacques, C. L., 20
 Ono, T., 30
 Owen, Andrew K., 43

P

Pack, LaTunia G., 40
 Palmer, Donald D., Jr., 53
 Pao, Jenn L., 6
 Parish, James M., 24
 Parker, A. J., 41
 Parker, Robert G., 21
 Patnaik, Surya N., 53
 Paxson, Daniel E., 31
 Pennington, Leon E., 12
 Peretti, Steven W., 48
 Perry, Chris E., 8
 Perry, R. Brad, 18
 Peterson, Linda M., 14
 Pfeleiderer, Elaine M., 20
 Pierce, Byron J., 43
 Pint, Steven M., 8
 Pirkle, Paul S., III, 32
 Poll, D. I. A., 49
 Ponomarenko, V., 57
 Price, Thomas, 44
 Pritchard, David E., 27
 Proffitt, David E., 48

R

Ramakrishnan, S. V., 4
 Ramchandran, K., 49
 Rasmussen, F., 54
 Reed, Aaron T., 32
 Remington, Paul J., 33
 Ren, Qu, 56
 Rius, Antonio, 17, 18
 Roddy, Jordan E., 34
 Rodgers, William G., Jr., 15, 16
 Rogers, James L., 38
 Rosch, Gene, 45
 Roth, P. G., 34
 Ruangwiset, Annop, 4
 Ruffini, Giulio, 17, 18
 Rumsey, Christopher L., 61
 Russo, M. S., 20
 Rustenburg, John W., 9, 28

S

Saganti, P., 62
 Sahai, Ranjana, 39
 Saito, T., 35
 Saiyed, Naseem H., 59
 Sakurai, Akira, 4

Sandusky, Robert R., Jr, 22
 Santoro, Ernest, 19
 Saus, Joseph R., 31
 Sawada, Hideo, 43
 Scheffey, J. L., 41
 Scheffey, Joseph L., 11
 Schell, Eric, 59
 Schiff, Conrad, 46
 Schvaneveldt, Roger, 15
 Seifert, Avi, 40
 Seiner, John M., 34, 35
 Seto, Danbing, 37
 Shavers, M. R., 62
 Shepherd, Robert D., 48
 Shuvalov, V. V., 61
 Simon, Donald L., 32
 Sinno, R. Ralph, 44
 Skinn, Donald A., 9, 28
 Smith, Donald M., 41
 Smith, Dudley, 13
 Smith, John, 23
 Smith, Mark E., 25
 Smits, Alexander J., 44
 Sobieszczanski-Sobieski, Jaroslaw, 22
 Soendergaard, H., 55
 Springer, Helmut, 52
 Staker, Rod, 27
 Stankovic, John, 53
 Steer, A. J., 21
 Steinetz, Bruce M., 51
 Steinschaden, Norbert, 52
 Sutliff, Daniel L., 33
 Suzuki, K., 1

T

Tabet, Robert J., 11
 Tamaru, S., 35
 Tan, Rendell K., 23
 Thiers, George, 26
 Thompson, Richard C., 14
 Tipps, Daniel O., 9, 28
 Tischler, Mark B., 26, 39
 Tomoshofski, Chris, 39
 Trenchard, Michael E., 27
 Trinh, Huu P., 47
 Truong, V. T., 20
 Tsujii, T., 12, 30
 Tucker, Richard, 15
 Tuecke, Steven, 58

U

Urnes, J., 7

V

Vandemark, Douglas, 55
 VanFossen, G. James, 31
 Veronneau, Stephen J. H., 14
 Vogel, Chris, 55

W

Wagner, Christoph, 45
 Wai, Ng Seet, 61
 Wakelin, Allison J., 11
 Walton, Joan D., 6
 Wang, Xue-Juan, 56
 Watanuki, T., 26
 Webb, Douglas C., 28
 Weeks, Frank, 44
 Weeks, Joseph L., 56
 Wehrmeyer, Joseph, 47
 Weller, S., 27
 Whalley, Matthew S., 26
 Wicklund, Dan, 59
 Williams, F. W., 41
 Williams, Frederick W., 11
 Williams, Kevin W., 14
 Wilson, J. W., 62
 Winder, Lee F., 9
 Wong, Tin-Chee, 6
 Wood, Houston, 59
 Wood, Kathryn J., 56
 Wood, Nancy L., 53
 Woodford, David, 58
 Woods, W. C., 2
 Woods, William C., 4
 Work, Kevin, 19

Y

Yamamoto, T., 35
 Yamasaki, Takeshi, 39
 Yang, Lee C., 16
 Young, Corissa, 59
 Youssef, Hussein, 38
 Yurkovich, R. M., 7

Z

Zak, J. Allen, 15, 16
 Zavorotny, Valery, 17, 18
 Zeiler, T. A., 28
 Zemlyanov, Alexander, 50
 Zimpfer, Douglas, 45
 Znidarcic, Dobroslav, 24
 Zoladz, Thomas F., 46

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